

April 8, 1957

50 Cents

# AVIATION WEEK

A MCGRAW-HILL  
PUBLICATION

Soviet Bear Engine  
Design Is Described

•  
Missile Launcher  
Would Test Thrust



Sikorsky HR2S-1 Lifts Bridge



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*Reaching with the sun at 615 miles an hour, Convair's 880 Jet-Liner will cut your travel time in half! The only jet transport designed to operate from hundreds of existing airports, it will bring silent, vibrationless flight to travelers everywhere—big cities and small.*

*Convair's 880 Jet-Liner, powered by General Electric CJ-645 engines, will be delivered to leading airlines\* for world-wide service beginning in 1959. In this new era of jet transportation, Convair's luxurious 880 Jet-Liner will be the world's fastest passenger plane—truly master of the skies!*

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\*LEADING AIRLINES TO TAKE ORDER CONVAIR 880 JET-LINER INCLUDE: TWA • Pan American • Transamerica, Etc. (Continued)



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## TYPE MB-1 AIR CONDITIONER

Stratos' experience with aircraft air conditioning systems has been applied to a new, lightweight air conditioner designed for use with gas turbine compressors such as the MA-1A and MA-2 types. Meeting Type MB-1 requirements, the unit is Stratos' Model GBA/20-1.

Composed of aircraft quality components, the system is packaged as a compact unit measuring only 48" x 50" x 30". The controls—connected to the package solely by an electrical cable—can be remotely located and, where desired, taken directly into the aircraft.

For additional data on Stratos' line of air conditioning systems, write to:

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A DIVISION OF TURBOJET ENGINE & ROTARY CORPORATION

Head Plant: Bay Shore, L. I. N. Y.  
Western Branch: 1820 Pennsylvania Ave. Manhattan Beach, Calif.



Stratos' Model GBA/20-1 air conditioning system being prepared for production test.

## AVIATION CALENDAR

Apr. 8-11—Fifth Wilding Show, Sheraton Hotel, Philadelphia, Pa.

Apr. 30—Insects of complex variety but  
none, collected and otherwise pretty  
rich, 10:30 a.m., Greenham Aircraft  
Engineering Co., Waltham 24g. 11  
Duxbury, 1. 1. N. Y.

**Apr. 18-19-National Nuclear Instrumentation Conference and Third Southern Nuclear Instrumentation Exhibit.** At Jack Wilmore Blvd., Athens, Ga.

Apr. 12—Flight Testing of Very High Performance Airplanes, NACA Presentation, Society of Experimental Test Pilots, Los Angeles, Calif.

Apr. 18-26-1917 National Symposium on Telemetering, sponsored by the Institute of Radio Engineers, Professional Group on Telemetering, and Remote Control Systems (Nat'l. Philadelpia, Pa.)

Apr. 19-17—Vespertine at Synchrotron for Initialisation Reflected, sponsored by West-  
coast Network University, Maxima Andika  
and, Cleveland, Ohio.

Age-Motion-Aircraft Ball Bearing Coaster  
cars, sponsored by New Departure Divi-  
sion, General Motors Corp., St. Louis.  
Hawthorn Drive

Apr. 16-18—Symposium on Nuclear Tests  
in Mesodestructive Firing, Moscow 10  
1st, Chicago, 12

Apr. 23—Muscle Service, New York Section  
Association of Chemical Engineers. 7:30

Apr. 23/25—Annual Convention, International Native Navigators Council, Parkville Hotel, New York.

Apr. 29—Fixed Flight Test Instruments  
Symposium, Statler Hotel, San An-  
gelo  
Apr. 29-May 1—19th Annual National Con-

**Apr. 1980**: American Society of Agricultural Weight Engineers, Broadview Blvd. Wichita.  
**Apr. 1980**: Atlantic City Community Fair  
(Continued on page 6)

AVIATION WEEK • APRIL 8, 1987

Vol. 88, No. 14



## QUALITY MAGNESIUM CASTINGS

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## AVIATION WEEK ■ APRIL 8, 1997

1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 26

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1. *Journal of the American Medical Association*, 1997; 277: 100-104.  
 2. *Journal of the American Medical Association*, 1997; 277: 100-104.  
 3. *Journal of the American Medical Association*, 1997; 277: 100-104.  
 4. *Journal of the American Medical Association*, 1997; 277: 100-104.  
 5. *Journal of the American Medical Association*, 1997; 277: 100-104.  
 6. *Journal of the American Medical Association*, 1997; 277: 100-104.  
 7. *Journal of the American Medical Association*, 1997; 277: 100-104.  
 8. *Journal of the American Medical Association*, 1997; 277: 100-104.  
 9. *Journal of the American Medical Association*, 1997; 277: 100-104.  
 10. *Journal of the American Medical Association*, 1997; 277: 100-104.

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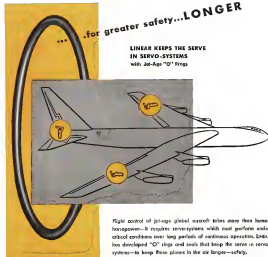
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**AVIATION CALENDAR**

(Continued from page 4)

- Food Meeting, International Air Transport Assn., Tampa, December, Eng. Ind.
- Apr. 10—Electronic Media for Helicopter Pilots, annual school meeting, New York, Section, American Institute of Electrical Engineers, 7:30 p.m., ITG, 35th St., New York, N.Y.
- May 23—Spring Meeting and Exhibit Society for Experimental Therm. Analysis, Hotel Statler, Boston, Mass.
- May 24—1957 Convention American Association of Airport Executives, Sheraton Hilton Hotel, Houston, Tex.
- May 24—7th Annual Meeting, Aero-Mech. of Man, Shirley House Hotel, Denver, Colo.
- May 24—Electronic Engineering Agents of Aircraft and Marine, American Institute of Aeronautics Engineers, Winston Hotel, Dayton, Ohio.
- May 31—1956 Annual Meeting, American Therm. Society, Sheraton Park Hotel, Washington, D.C.
- May 31—1957 National Conference on Aeronautical Electronics, sponsored by the Institute of Radio Engineers, Dayton, Ohio.
- May 1957—4th Ann. Airport Conference, Air Transport Division, American Society of Civil Engineers, Park-Metropolitan Hotel, New York.
- May 28—2nd Annual Aviation Fire Safety Conference, National Fire Protection Assn. Hotel Sheraton, Los Angeles, Calif.
- May 24—June 2—2nd Port to Stars, Seaside at Lincoln National Convention, Le Borgia Airport, Ohio.
- June 1—1957 Annual Maintenance and Operation Meeting for Remains and Entry to the Aircraft Division, sponsored by Reading Aviation Service, Reading Municipal Airport, Pa.
- June 1—5—6th Annual National Aviation Trade Show, Massachusetts County (N.Y.) Airport.
- June 17—20—National Summer Meeting, in honor of the anniversary of the Wright Brothers, Sheraton Hotel, Los Angeles, Calif.
- June 23—25—7th Annual Meeting, Aviation Development & Maintenance Assn., The Broadmoor, Colorado Springs, Colo.
- June 24—30 at National Aviation Day, Vienna.
- July 2—1957 National Seating Conference, Elms, N.Y.
- July 12—15—Royal London International Aeronautics Competition, the National Air Race, County of Kent, Kent, England.
- Aug. 18—25—Western Electronic Show & Convention, Cox Plaza, San Francisco, Calif.
- Sept. 14—26th International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Palladium and London, England.
- Sept. 24—1957 Flying Display, Society of British Aircraft Constructors, Farnborough, England.
- Nov. 25—Weapons Section Management Meeting, Sheraton Hotel, Dallas.
- Dec. 17—1957 Aviation Lecture, Department of Commerce, Washington, D.C.



Flight control of jet-age global aircraft relies more than human horsepower—it requires servo-systems which must perform under critical conditions over long periods of continuous operation. Linear has developed "O" rings and seals that keep the serve in servo-systems—to keep these planes in the air longer—safely.

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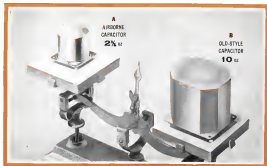


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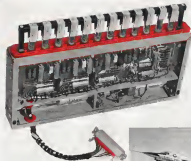
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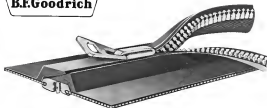
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OF APPLICATIONS**



Pressure Switch	10 to 20 psi	20 to 40 psi	40 to 60 psi	60 to 80 psi	80 to 100 psi	100 to 150 psi	150 to 200 psi	200 to 300 psi	300 to 500 psi	500 to 1000 psi	1000 to 2000 psi	2000 to 5000 psi	5000 to 10000 psi	10000 to 20000 psi	20000 to 50000 psi	50000 to 100000 psi	100000 to 200000 psi	200000 to 500000 psi	500000 to 1000000 psi	1000000 to 2000000 psi	2000000 to 5000000 psi	5000000 to 10000000 psi	10000000 to 20000000 psi	20000000 to 50000000 psi	50000000 to 100000000 psi	100000000 to 200000000 psi	200000000 to 500000000 psi	500000000 to 1000000000 psi	1000000000 to 2000000000 psi	2000000000 to 5000000000 psi	5000000000 to 10000000000 psi	10000000000 to 20000000000 psi	20000000000 to 50000000000 psi	50000000000 to 100000000000 psi	100000000000 to 200000000000 psi	200000000000 to 500000000000 psi	500000000000 to 1000000000000 psi	1000000000000 to 2000000000000 psi	2000000000000 to 5000000000000 psi	5000000000000 to 10000000000000 psi	10000000000000 to 20000000000000 psi	20000000000000 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## EDITORIAL

### The Value of Research

Today we are flying a roster of Mach 2 fighters and a supersonic bomber that can also act as the early warning of Mach 3 interceptors. The North American F-107, the Republic F-105A, the Grumman F11F-1F and the Lockheed F-104A are all fighting adversaries in the Mach 2 class. The Convair B-58 Hustler is the first truly supersonic bomber in the world. The U.S. also was the first to fly both high-speed, current-based fighters capable of Mach 1 to level flight—USAF's North American F-100 and Navy's Douglas F4D. It also produced the first 1,000 mph. current-based fighter in the Chance Vought F8U-1 Corsair.

All of these achievements during the past three years are the very practical fruit of the high speed research aircraft program, begun 12 years ago under the joint sponsorship of the Air Force, Navy and the National Advisory Committee for Aeronautics and administered by a quartet of aerospace manufacturers, two pioneers in modern applications of rocket power and a score of military and civilian test pilots.

At a time when the value of various types of scientific research activity are being sharply questioned by "defense-wise, letch" in the scientific and public fields, it might be wise to look at the record of the past high speed research aircraft program over the past decade. It was a costly program both in dollars (probably close to \$100 million) and in lives. Four pilots lost their lives in the research aircraft series—Howard Lilly of NACA, Jess Ziegler of Bell Aircraft Corp., and two USAF pilots from the Flight Test Center at Edwards AFB, Capt. William Apt and Maj. Raymond A. Rogers.

The research aircraft program was originally conceived in 1949 by Gen. Homer H. Arnold when he was chief of the Ames Air Force in World War II and Dr. George W. Lewis then director of NACA who at that early date were already confronting the attainment of supersonic flight in the next decade.

By the end of the war in 1945, it had solidified into a firm program that was to see the first, technical history of the supersonic era at piloted flight.

The complete list of people who made major contributions to this program during the subsequent 10 years is too long for mention here. Among its leaders, however, were:

In the early phase, John Stack of NACA who also spearheaded the flight program and development of the transonic wind tunnel, Tom Ketcher of Wright Field, Tom Yon and E. W. Corbin of the Navy Bureau of Aeronautics, the Bell Aircraft Corp. team of Larry Bell and Bob Woods, and the Douglas engineering effort spearheaded at El Segundo by Ed Heinemann and at Santa Monica by Ed Barba.

In the rocket power development that was to prove decisive in pushing the research aircraft all the way to Mach 5, the work of Jim Wolfe at Reaction Motors Inc. on regenerative cooling and the Curtiss-Wright group that developed the first practical rocket throttle controls were vital. Other key men included Carl Reichert chief of the aircraft laboratory at Wright Air

Development Center and Bob Staley, then with Bell, who developed the northern plane design technique that contributed to much of the useful high speed data yielding runs of the hottest research aircraft. The work of Maj. Gen. Al Boyd and Brig. Gen. Stan Hoffman, who were the successful commanders of the USAF Flight Test Center at Edwards AFB, and Walt Williams, who headed the NACA flight section at Edwards also provided a sound foundation for the program operations. Among the pilots who contributed so much to extending the frontier of piloted flight were Chuck Yeager, Pete Egan, Scott Crossfield, Joe Wolfan, Herbert Hoover, Kit Merriam, Bill Bridgman, Ivan Kachalov and others.

Finally about 15 aircraft were included in the program including some not originally planned for that work, such as a specially constructed B-47 accepted by NACA to investigate high speed, load problems and new designs, and the Convair XF-99A that was used most successfully in pioneering the delta wing design now proved out in the F-107 and F-105 all weather supersonic interceptors, and the B-58 supersonic bomber. The Bell X-1 series and the Douglas D-558-II proved to be the work horses of the specially designed research type. The X-1 was the first aircraft in the world to reach the speed of sound, the Skyrocket was the first to hit Mach 2 and the X-1A was the first to hit Mach 2.5.

The X-2 recently completed the current phase of the program by reaching Mach 3 before going out of control and crashing. Less spectacular, but equally productive, were the Bell X-5 with variable sweep wing that explored the last 50 degree research data, the Northrop X-4 that tackled stability and control problems of hollow aircraft in the low transonic range and the Douglas X-3 that provided extremely valuable data on the new pile concept of inertial coupling.

Another important feature of this program was the speed with which data obtained from the high speed flights was fed back into the industry design and engineering circles. From the first supersonic flight at the Bell X-1 at 70,000 ft. in 1947 to the first flight of the first truly supersonic operational fighter—the North American F-105—in 1953 was only six years. Today, fighters are in operation at the 70,000 ft. altitude that the X-1 barely touched in a minimum climb.

The last test flight of the Bell X-2 that hit a maximum speed of 3,175 mph. brought to a close the high speed research aircraft program as it was originally conceived. There is no doubt that the program was a major factor in extending the frontier of piloted flight into the fringe of space at 126,000 ft. altitude and out to three times the speed of sound. A new phase of the program is already under way scheduled in the North American X-15 designed to carry runs at speeds of Mach 5.

As long as this country has the courage to invest wisely in long range astronomical research, the industry, engineers and pilots will accept the challenge and run the risks that are necessary to keep us experts in the air and put us out into space, too, if required.

—Robert Hutz



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## WHO'S WHERE

### In the Front Office

**H. A. Knapel**, *executive vice president of the company*, a director, Thompson Products Inc., Cleveland, Ohio. Also: **William T. Rame**, *vice president*.

**Robert J. Feltman**, *president, newly organized Trapp Manufacturing Co.*, a Division of Trapp Industries, Inc., Fortville, Ind.

**Donald M. Chang**, *president*, George L. Norcross Co., Detroit, Mich. Mr. Chang succeeds **George L. Norcross**, deceased, who headed the company.

**Malvin J. Melman**, *president*, The Allen Manufacturing Co., Hatfield, Pa. Also: **Edward K. Groat**, *vice president-manufacturing*.

**R. K. Handley** and **Orel D. Reay**, *vice presidents*, Iron Vacuum Manufacturing Co., Fairfield, Ohio.

**Norman D. Anderson**, *vice president*, Fluorocarbon Transfers Division, Electrochemical Corporation of America, Cambridge, Mass.

**Edward D. Gray**, *vice president*, Pease Instrument Company, Inc., Great Neck, N. Y.

**Leo J. Kaylor**, *vice president technical staff*, and **Robert L. Towner**, *vice president office*, Air Transport Association of America, Washington, D. C.

**Henry J. Frenkel**, *contract manager*, Pratt & Whitney Company, Inc., West Hartford, Conn.

**Dr. John C. Clark**, *chief scientist* to the manager of *Aerodynamics Division*, Consultant, a Division of General Dynamics Corp., San Diego, Calif.

**Marvin Wachen**, *executive assistant to the president*, Colson Industries, Inc., Milwaukie, Ore.

**Charles J. Schmitt**, *Washington, D. C. district manager* (Silver Spring, Md.), New Gas Division, Wheeler Kidde & Company, Inc., Belleville, N. J.

### Honors and Elections

**Dr. Ronald Salsburg**, formerly with the Naval Research Laboratory and now chief scientist of Aerobics Instrument Laboratory, Inc., has received the Department of the Navy's *Myron H. Cohen Award* for the most significant award given to a civilian employee in recognition of his major contributions to the Laboratory's program and to the field of electronics.

### Changes

**J. E. Van De Walle**, *chief engineer*, Griffin Aircraft Products Corp., Gardiner, Calif.

**George J. Castello**, *manager*, Ordnance Products Dept., The W. & M. Morse Corp., New York, N. Y.

**Robert G. Bryan**, *assistant general manager*, Dennison Research Associates, a Division of Unimac Mfg. Corp., Raytown, Mo.

**Capt Eugene M. Beattie**, *manager*, General Electric Company's electronic aircraft systems, New York, N. Y.

## INDUSTRY OBSERVER

**Marbles** for Clancey Vaughn's F8U-3, an improved version of Navy's F8U-1, is now being processed. The aircraft, which will be substantially faster and larger than the F8U-1, will be powered by Pratt & Whitney's J75 turbojet engine (AW April 1, p. 25). F8U-3 is still in the wind tunnel in two years away from flight status.

**Fuel** & **Whitney** will conduct weight and mission problems in one mission of its J75 turbojet engine through the investigation of substituted amounts of titanium alloy in applications under to those used in the company's J57.

**Clancey Vaughn Aircraft** will evaluate possibility of protecting the aluminum alloy skin of fighter fighters with a sheath of plastic in order to withstand temperatures of up to 700 degrees.

**Lockheed Aircraft** may use the Westinghouse J14 turbojet engine in its next generation of the J2V-1, new version of the Groundwater radar platform being built for the Navy.

**U. S. Army Aviation** is moving increasing attention from aircraft manufacturing into development of new aircraft for the Army and USAF. From, including North American, Grumman, Northrop and Douglas, are making an effort to meet Army requirements despite the service's determination to build down development costs and less heavily on off-the-shelf items wherever possible.

**Approximately 50%** of the exterior surface of Northrop Aircraft Inc.'s supersonic F-38 bomber will be processed with chemical milling for removal of excess material.

**Office of Naval Research** has received six gold-plated magazine systems for Project Vanguard from Brooks and Paxson, Inc., of Detroit. First order contains on the above air being supplied by Army Corps of Engineers research and development laboratories at Ft. Belvoir, Mo. First magazine goes over the gold plating—the active line of chemical, a repeating layer of silver monoxide, a layer of highly reflecting aluminum and a thick final layer of white monoxide. Silver monoxide sheath reduced ripples and coats heat to protect the aluminum.

**First design studies** for Army's flying crane are being delivered for evaluation. Apparently no construction are taking part in the competition. Army's Transportation Corps will study the results, then report what is available at that point. Effort is being made to avoid waste of money and engineering talent on projects with little promise.

**Thompson-Rumpler's R304** low thrust turbojet engine has completed its 150-hr. endurance tests. The new engine, a derivative of the earlier R300 which delivered a base design thrust of 2,000 lb., has a thrust of over 3,000 lb. without afterburner. The engine, an axial flow type with seven compressor stages and one turbine stage, is designed for use in lightweight fighter aircraft.

**Researcher** is taking a hard look at various methods as to apply to manned rocket flight. One new look, "Medical Problems of Interplanetary Travel," is a collection of theoretical and experimental data compiled by doctors outside the USSR with comments by Russian medical authorities. American rocket engineers with side and readers are asked.

**Experiments** related to the space travel project have established the first body of cutting and dissipation during a condition of weightlessness. The studies, conducted by the School of Aeronautics, Massachusetts Institute of Technology, employed a Lockheed F-94C following a parabolic flight path that attained altitudes of weightlessness as high as 45 sec.

**French air force** will use phased out de Havilland Vampire trainers in radio-controlled target drones. First radio-controlled Vampire recently flew from the air base near Concarneau.

## BEYOND THE POINT OF NO RETURN?



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## Flying Time Can Be Calculated Accurately

The range and engine efficiency of today's modern jet depend upon a precise calculation of fuel consumption. And since fuel density varies according to the type and temperature of the fuel used, measuring the number of gallons consumed is not enough. Therefore, General Electric has developed a mass flowmeter that measures the rate of fuel consumption in pounds rather than in gallons.

**GREATER PROTECTION FOR PERSONNEL** is possible with the General Electric Flowmaster System. Knowing the exact rate of fuel consumption and knowing the weight of his fuel supply, the pilot at flight engine can readily compute his remaining flying time to a degree of accuracy never before possible. Almost as important, he is better able to evaluate the operating efficiency of his engine.

**WIDELY USED** in the aircraft industry, hundreds of General Electric Flowmaster Systems are now operating in B-47's, B-58's, and KRB 80's. Growth versions

of this equipment will soon be installed in Air Force B-52's, C-130's, C-119's, and KC-135's, as well as other new military and commercial aircraft.

**ONE OF THE NEWEST APPLICATIONS** for General Electric Mass Flowmeter Equipment is in aircraft engine test facilities where extremely accurate fuel-consumption measurements are required in development, design, and production.

**OTHER GENERAL FEATURES** offered by the General Electric Flowmaster System include an easy-to-read, expanded scale indicator, wide temperature and load ranges, hermetically sealed circuits, and light weight.

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## Washington Roundup

### Twining: Research Confined

USAF Chief of Staff Gen. Nathan F. Twining sees the Air Force in "disastering or defense" non priority research and development projects with additional "potential future payoff" because of budget savings.

"Along research cycle, stemming from and coupled with research completion, tend to combine our research and development to a maximum level," Gen. Twining told the Senate Armed Services Committee last week. In contrast, the Senate appears to be pushing them research and development across a broad scale has broadened considerably during the past few years.

Gen. Twining, soon to become chairman of the Joint Chiefs around the committee that to achieve striking force the Air Force is "essentially strategic than the Soviet," and that one of relative position has improved over the past year because of his (three)-measured B-51 production and a downgrading of intelligence estimates of Soviet capabilities. "On technology estimates," he said, "of present and future Soviet strength, there have been a great many changes to get better intelligence."

Gen. Twining stressed USAF's capabilities as "broad and" and expanded protection the board to discount the possibility of total war because it would be out of control. He said, "The Air Force is not a strategic capability of U.S. and Soviet capacity."

• **Medium jet launchers**—"We continue to understand the Soviets by a wide margin. Current estimates indicate that we will keep the lead, but that it will dwindle as the budget situation jet launcher comes into the Soviet inventory."

• **Light tactical bombers, day fighters and fighter bombers**—"Here the Soviets have held and will continue to hold a very good numerical advantage."

• **All weather interceptors**—"We are well ahead in number type both in quality and quantity."

• **Transport aircraft**—"The U.S. remains, and will remain, a big numerical lead. However, from the standpoint of transport aircraft performance, we must remember that the Soviet Union is the only nation now operating jet transports over scheduled routes."

### Hector Joins CAB

Leon J. Hector, 41-year-old Florida lawyer, was sworn in last week as a member of the Civil Aeronautics Board following his unanimous confirmation by the Senate. Hector fills the vacancy left by Joseph Adams whose term expired the last of the year and whose first term ended in 1967. Hector was born in 1926, earned his law degree from the University of South Florida, and was admitted to the Florida Bar. He was a member of the Office of Aeronautics, Government of Florida. He was educated at Harvard and Williams College, earned his LL.B. at Yale Law School and studied at Oxford College, England.

### Symington Pushes Economy

Sen. Stuart Symington (D-Mo.) is the forefront of a congressional economy drive whose leaders maintain that "real sense" could be cut from the administration's \$15 billion defense budget for Fiscal 1958 if there were an adequate savings doctrine.

Sen. Symington told the Senate that "the last word will go back unless it starts building its defense on the

basis of progress instead of tradition." The belief, he said, "must be supported by the fact that money which involves unnecessary duplication, and even duplication, always at the expense of the future, is not, as we are being requested to appear arms, industrial persons of which are particularly in need."

"The present issue for the subcommittee is the cost of the future, on the part of the executive branch to decide how best to defend this country in case it is ever attacked."

Last week, Symington was a key supporter of the Democratic vote to add \$980 million to USAF's budget. He apparently hopes for a cut this year in the budget aspects of the other two services, although he has previously supported Democratic-sponsored proposals to increase funds for the Marine Corps and the Army.

### Congressional Outlook

Look for the Senate Commerce-Aeronautics Subcommittees to give its approval to legislation granting permit near certification, subcommittee of the Senate Committee on Aeronautics, Fighting Ties, Radio and Aeronautics.

Despite a non-concurrent attitude in the Civil Aeronautics Board in testimony last week, strong support of the measure, House, Sen. John Stennis (D-Miss.), subcommittee chairman, Sen. Andrew Schoenwald (R-Iowa), and Sen. George Smathers (D-Fla.).

Other congressional developments included:

• **Legislation that would establish an Office of Civil Aeronautics Medicine** headed by a Civil Air Surgeon under the authority of the Civil Aeronautics Administration was approved by both the CAA and CAB. Only support came from Dr. Herbert Frome, president of the Civil Aeronautics Medical Association, as testimony before the Senate Commerce-Aeronautics Subcommittees.

• **Legislation authorizing subcommittee to set aside savings from equipment sales for new equipment purchases** was introduced by Sen. Warren Magnuson (D-Wash.), chairman of the Senate Commerce Committee, and Rep. Owen Harris (D-Ark.), chairman of the House Commerce Committee.

### Aircraft Equipment Plan

Civil Aeronautics Administration is asking for \$494 million to purchase aircraft equipment, including the new Vortec as a result of the adoption of Vortec as a Common System. Cost of operation of the new system beginning in 1962 is estimated at \$450 million annually—an amount that will be covered in part by cost changes on military, commercial and private operations. As the program develops, it is possible that new charges will be levied to provide a self liquidating operation. The CAA is also asking for a supplemental appropriation of \$15 million to 1957 budget to cover immediate costs of implementing the Vortec system.

Original estimate for initial implementation between 1957 and 1961 had been set at \$240 million, but the introduction of Vortec alone is expected to cost \$275,450,000 plus \$15,530,000 for VTC costs. The total of \$310.98 million will give the U.S. complete coverage by 1965 with 1,230 Vortec and 288 ILS/VTC aircraft. The latest revised estimates were reviewed in the interim late last week of the House Appropriations Subcommittee.

—Washington staff

# Curtis Will Urge New Aviation Agency

Clear statutory authority to develop and evaluate traffic control solutions will be sought for new group.

By Philip Klum

Washington—Speedy formation of a national aviation traffic agency to research, develop and evaluate new traffic control solutions to solve growing traffic control problems will be recommended this week by Edward P. Curtis, special assistant to the President for aviation legislation planning.

The recommendations will be made as an interim report, the first in the Curtis group's one year study. It is expected to deal primarily with organizational recommendations. Curtis will submit his complete report to the President early in May.

## Combined Duties

The proposed agency would assume duties of the responsibilities now shared by a body group of agencies, including the Civil Aeronautics Administration, Air Command and Control, Air National Development Board, Radio Technical Commission for Aeronautics and the three military services.

To avoid the redundancy which long plagued the ANDR, Curtis will argue that the new agency's responsibilities be clearly defined by statute. Further, he will propose that it be given its own funds for construction purposes and not be dependent upon the largess of other government agencies.

Curtis also will recommend that the new agency include a major element: three services which are aviation technology, research and development activities which are increasingly related to civilian aviation operations. Curtis will support the temporary use of CAA's Technical Development Center in Indianapolis or the Air Force Command Research Center facilities at Ft. Davis, near Boston. However, he is expected to recommend a large, new aviation flight operations facility for permanent operations.

Recognizing the difficulty of creating an independent scientific and operational authority to staff the new agency with selected civil service aviation technicians in the current tight manpower market, Curtis will recommend that the military services assign some of their experienced personnel to the new agency on a temporary basis, until it is well along with the Civil Aviation Agency.

Civil service and military personnel will be supplemented by:

- Hiring specialists from research and development laboratories in Stanford Research Institute, Aerospace Instru-

ments Laboratories and other groups.
- Contracting specific research, equipment development or evaluation projects to industry.

Recent speeches by Curtis, James L. Asmus, his aviation planning advisor, and other members of his staff, have given a tip-off that Curtis was thinking along these lines. Speaking at the recent Institute of the Aeronautical Sciences meeting in New York, Curtis said there was no "single remedy" which could solve current traffic control problems overnight.

The solution, Curtis said, requires a "system development organization, backed by the best talent in government and industry, organized to work continuously on these ever changing problems." The only mechanism he has today is a complicated maze of committees which endeavor to resolve conflicts as they arise.

Speaking at the recent Air Line Pilots Association meeting in Chicago, Asmus called for a "single line structure, composed of full-time scientists, engineers and experimenters experienced in air and aviation personnel" to replace today's "part-time committees and boards." Thus, Asmus said, would make it possible for Common System Research and Development to be determined from scientific and experimental data instead of being directed by "political tactics and arbitrary ruling."

## Flight Evaluation

The flight evaluation facility which Curtis is expected to recommend will require a major aerial, several satellite facilities, and perhaps 100 to 150 aircraft. This solution is based on a paper by Edward J. Preper, a member of Asmus's

staff, delivered recently before the Institute of Radio Engineers. The facilities Preper envisioned, would require an estimated technical people and a usual annual budget of \$25.50 million.

Despite the usefulness of simulated and simulation techniques, Common System planners can not hope to develop realistic solutions to future traffic control problems unless they are able to test their ideas and hardware in a "real world situation," Preper stated.

## Other Recommendations

The report which Curtis made to the President in May is expected to include use the necessity of looking as much as possible for new and more sophisticated means for the past five years with his numerous equipped aircraft.

However, Curtis will likely back the philosophy of controlled airspace as both his and best method at high altitudes and in high density terminal areas. This is in line with recent CAA policy of controlling all airspace above 25,000 ft., a figure expected to drop to 15,000 feet in 1975 (AW April 1, p. 45).

Below these altitudes, along certain heavily traveled airways, Curtis is expected to recommend a new type of service and "ticket" for pilots who do not use hold equipment (OAS) ratings but who would like to obtain "priority" separation from ground traffic control along these routes.

Under the plan, pilots would not need to submit to the same procedures now required for a full FFR rating but their aircraft would have to be equipped for VOR navigation and communication with traffic control systems.

The answer to the President will recommend use of one-way airways and traffic separation by aircraft speed over high density routes. Curtis also is expected to recommend a new type of "clearance" or "routing" procedure, modeled after the U.S. glide slopes, to expedite the approach of high speed aircraft from controlled airspace into the terminal area. The system, which is envisioned will require the development of a radio or radar "fence" to mark the boundaries of controlled airspace or low altitudes in order to keep out intruding aircraft. The system, which must be light weight, low cost and permit independent use by private firms.

Another challenging area for the aviation industry is the design of low altitude routes where low altitude traffic patterns (LAP) would make possible autonomous communication channels or positive separation means.

In the report to the President, Curtis will point out that the development of a systematic computer and data pro-



SCOOPER, the present space reconnaissance vehicle. Flag-like antennas on other side would reject cosmic heat.

## Ion Rocket for Space Exploration Proposed at Rocket Society Meet

Washington—Rocketdyne Division of North American Aviation Inc. disclosed here last week that it is one of two USAF contractors studying the feasibility of ion propulsion for space vehicles (AW Feb. 18 p. 37).

The Rocketdyne engineers also met here with a proposal for a nuclear powered ion rocket capable of sustaining flight to make scientific observations of the solar system.

## Japan Will Decide Between F-104, F-100

Tokyo—Japan Defense Agency will shortly decide whether Japan should purchase domestically the F-104 or the F-100 supersonic jet fighter. At present, it is not sure which of the two planes would be best suited to this country's defense needs.

Kawasaki Aircraft has filed with the defense agency plans for production of the F-104 with technical cooperation from Lockheed Aircraft. Kawasaki currently is negotiating with the firm North American Aircraft has submitted to the agency plan to produce F-100 into an all-weather fighter.

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In addition, the electric current would operate the jets collecting and slowing electrons during the outer reconnaissance flight.

The two agencies say Scooper is entirely feasible in terms of current technology and holds several advantages over other orbiters and recon probes for space flight based on multi-stage chemical rockets.

In a formal announcement of an Air Force contract, Rocketdyne said the company under a contract to give that the report of its research will be the feasibility of ion propulsion itself.

Rocketdyne says the system of slowing thrust ions high velocity charged particles will not produce the power needed to be observed rocket propulsion systems. But this means the application appears confined to use high altitudes, where an ion engine developing a few ounces or pounds of thrust might accelerate a vehicle weighing thousands of pounds to great speeds. Fuel consumption would be low.

Comparison of the proposed



**Vanguard Gantry**

First view of the gantry, built to handle the three-stage Vanguard vehicle, shows a launch area Viking test vehicle (left). Viking is being cradled for static testing and launching on Vanguard's launching platform. Gantry is mobile, rolling on wide-gauge rails to launching site to help prepare the rocket, then backing away prior to a launching. Viking and Vanguard are made by the Glenn L. Martin Co., Baltimore. The static test and launching platform and the gantry were designed, built and installed by the Navy Hydrographic Division, Balboa-Lane Naval Station, New York.

Snooper vehicle, which apparently only use of several possible applications if the propulsion is performed, is highly sensitive.

Partial section of the vehicle will be separated from the part containing the rocket propulsion, the telescoping, side to protect the guidance system and instrumentation from the effects of radiation.

Ordnance is estimated at 1,500 lb, gross weight at 1,700 lb. The vehicle is a gas propulsion system will weigh approximately 1,000 lb. The next heaviest component will be the rocket at 280 lb.

#### **Sodium Content**

The vehicle will use a sodium content, and its design clock was one of the major problems encountered by Whitehall and Dr. Daring the early part of a flight, while Snooper is propelled by a conventional rocket the vehicle will be wrapped around the vehicle and the sodium-potassium system is designed to flow a compact assembly.

Once Snooper is in orbit all excess hardware will be dropped and the vehicle unpowered of a few weeks to weeks. At the same time, the sodium-potassium system will be extended and the vehicle will continue to gas altitude until it is in the orbit of the planets.

Snooper's design is a two-ton rocket motor during this lifetime

power from a sodium reactor will provide necessary firing along with control to operate the rocket system for sending data back to the earth. The sodium content can be reduced to decrease Snooper without changing the rocket propulsion of the vehicle in space.

For all of the Snooper and include television, radio, communications equipment and sodium power system. Radio transmitter and electronic system will be used by sodium transmitter, camera and television device.

Hydrazine will perform such tasks as:

- Television and radio scanning of the surface of planets. The signal can be recorded on tape, coded and trans-

mitted to listening posts on the earth.

- Mutual navigation can be achieved by use of other astronomical

- Measurement of cosmic rays, electromagnetic fields and solar effects.

Guidance for Snooper would be provided by an electronic guidance system.

The ion motor is basically created by a design by Dr. S. Stokhagen of the Navy Ballistic Missile Agency in Huntsville, Ala. It has a liquid engine in a vapor to an ionocatalytic reaction inside. From this gas would come accelerated ions to provide thrust at high altitudes.

#### **SUPERSONIC TEST SLEDS**

Increasing importance of supersonic rocket tests in research tools has forced a trend toward liquid propellant, especially for programs requiring a large number of runs, one of long duration, or one requiring constant velocities.

Reaction Motors, Inc., has a contract to design two large liquid-propellant model vehicles to propel test sleds at the Air Force Flight Test Center, Edwards AFB, Calif.

Aerodyne-General Corp. has designed and completed two liquid sleds to be used by the Supersonic Naval Ordnance Research Test (SNORT) at the Naval Ordnance Test Station, China Lake, Calif. It now is building the rocket engine and tailfin for a

third sled to be used by Caltrans Engineering Co. at the Research and Development Command's Supersonic Military Air Research Truck (SMART) at Eglin AFB, Fla.

C. E. Rask, Jr. and H. M. Polard of Aerojet told the Aerospace Rocket Society that the application of liquid propellant is "a well-developed technology, but it is still in the early stages of development." The two SMART liquid sleds, the AJ10-13 and the AJ10-16, have an average 45 static tests and 16 dynamic tests.

These design requirements, although not detailed, covered these ranges: 180,000 lb. payload; load to sea G acceleration, 1,500-1,600 g; maximum velocity, 12,000 G deceleration, 0.31 to 0.111 G maximum range.

#### **SMART**

The AJ10-13 sled for SMART represents a "breakdown" design. Rask and Polard said. Its range is 1,700-2,500 ft; payload, 9-18 G acceleration, 2,400 g; maximum velocity, 88,100 G deceleration, same temperature range as static.

R. Davis and D. S. Smith of Reaction Motors said liquid engine after smooth acceleration without shock, constant velocity and lower speed over a number of tests than solid propellant.

The RMO product will propel sleds mounting ballistic missile components or structures over a wide range of velocities up to Mach 3. Payloads include velocity because they can be used with a wide variety of sled mounts.

The first product will be transport of payload of 5,000 lb. sled and structure and maximum air velocity between 900 and 1,100 ft/s. The second it also must be capable of maintaining and accelerating at 1,150 ft/s and 1,675 ft/s.

The second sled will be capable of accelerating and maintaining a velocity from 100 ft/s to 1,500 ft/s for two seconds while payload is 10,000 lb. sled and structure. Total rocket firing time will not exceed the equivalent of 13,000 ft. distance under dynamic operation.

#### **Edwards Test Track**

A project to develop and extend the 13,000 ft track at Edwards to 20,000 ft and to provide additional supporting facilities has been approved, according to a report by Rask & Rask, chief of the engineering section at the Air Force Flight Test Center.

Speed capabilities will be extended to near the Mach 1. Apparently the test sleds will be used on this 20,000-ft track. Track lengthening will increase test distance and time lab

## **Vanguard—From Assembly to Firing**

Washington—Four sites of the complex support equipment required for Project Vanguard are given last week by Stan Williams, Glenn L. Martin Co.'s Vanguard product design project supervisor, in a paper presented to the American Rocket Society's spring meeting. Here is a summary of what happens to a typical Vanguard rocket from assembly at the Martin plant in St. Louis to launch at Patrick Air Force Base, Fla.

- **Elemental checkout.** When manufacturing is complete, first and second stages are placed on showcases, called wheel dollies heavy enough so that difference during transportation will require minimum loads on the rollers. A system checkout is made using a rocket test engine designed and manufactured by Polaris Division Corp., with a Monopropellant-Hydrogen gas ammonia pump and Martin propellant gas pump. Sources of electrical, hydraulic and pneumatic (helium) power also are required.

- **Vertical checkout.** The vehicle is oriented and placed in a fixed support of two lifting test vehicles at once. Daily design allows remote vehicle control being imposed on the rocket. Cords and pressure are attached to the guided power plants as a test checkout of the control system can be made. The rocket test engine is spun and

- **Thrust and rebirth.** The vehicle is shipped to Patrick, and after a complete inspection, hydrostatic tests performed at Martin are duplicated in a larger analog to the program.

- **Static firing of second stage.** Many components of the launching complex are at the launch site, shared by Vanguard and another project, equipment base, including hydraulic power supply, lift support structure, launch structure, Martin dolly, power lines, communication cables, which support the cable and other connections to the second stage. Two firing stands, supplied by Lavery Hydrogen Division of Baldwin Engine Division Corp., (patents p. 20) can be mounted on the support structure over the static firing of the second-stage engine, one on static and flight firing of the first-stage engine.

The third launch station line consists with roughly the same units as in the second checkout at Martin. The launch site contains a Polaris Electronic power supply and a Baldwin Engine Division test engine. Details on p. 20. The second stage is moved into position on its dolly and moved by an eight-ton capacity crane. High test engine is supported by the launch site, the launch structure and water jet nozzle system has been installed on the support structure, and decontamination shower has been supplied.

- **Static firing, first stage.** After static firing of the second stage, the first and second stages and the same same-made of a solid rocket motor material with a titanium tie-up assembly. First stage is attached to the firing stand by a structure which extends directly from the thrust cylinder guided side. This engine is attached to the rocket body by tie-downs and allows a large static test. Liquid oxygen and ammonia are supplied to first-stage propellant tanks from conventional transport vehicles, but, in present line of the tie-down structure remains alone, the supply can be tapped up to the amount of launch from an isolated tank in the jet system at the launch area. Hydrogen pressure is fed into the vehicle with a specially-designed pump from specially-designed venting stations.

- **Flight.** After static firing, complete system checkout and instrumentation tests are performed. Now the vehicle must be moved with the vehicle to within one inch of a degree. Cords attached to the vehicle and optical equipment supplied by Kroll and Kane Co. are used. The sophisticated third stage—when it is stored and loaded in a rocket—has now installed test stage, using special dolly to ensure it does not slipping, contains with ammonia pump. The third stage is separated and also is attached. Alignment of the third stage with the second stage gas reference is "very critical." Without and, since the third stage has an optical system test depends on optical alignment. Alignment is done with an optical leveling device. Next step is addition to prepare for the vehicle jets that will control the second stage in lift, push and row during its control phase. The vehicle now is ready for conditions and firing.

Williams outlined aspects of instrumentation and of equipment on the vehicle, "after these systems are not integrated part of the launching vehicle and will vary."

## **British Sling**

London—After Afters Rocket T-1 S. Chief of Naval Ordnance, retired during his visit to Britain last week to a British airbase in a guided missile called "St. Sling."

This missile has been seen in a photograph by the Ministry of Defense in Britain's Atlantic Fleet and the U. S. Navy last week "concealing" against the British fleet.

It is believed to be the missile being used in the British fleet, the British guided missile tank ship, and placed for use in the new fleet divisions.





testing and has proved successful so far.

- Other developments include:
  - Composite designs which save space when not in use.
  - MA-2 engine design which will include auxiliary capabilities and a version which will operate in tandem two versions of 1500.
  - Hydrodynamic design have only for pulse design without an increasing trend for future installations. Coupled with new electronic drives.

#### HIGH-SPEED TURBINE FAILURES

Successful turbine wheel high speed turbine has been built and tested by the Avanti Aircraft Turbine Dept., General Electric Co.

GE had the choice of two basic approaches to preventing damage from an impending failure:

- Automatically lowering speed of the wheel by closing the air inlet passage or automatically locking the wheel at turbine speed. Although attractive, these methods of preventing wheel burst create design problems. Because of the wide operating range required of most turbines, which result in other weight increase, performance decrease or both.

- Constraining turbine wheel within the turbine housing under all possible wheel burst conditions, either by restraining the turbine housing to withstand the burst at a high weight penalty or by building a "frangible" turbine wheel which will burst at an accurately controlled burst speed with the effect of the burst relieved by lowering turbine speed and weight.

#### Frangible Wheel

GE scientists chose the frangible wheel approach. They designed an alloy steel turbine wheel which had a wheel which is light between alloy blades were attached to the steel pins. The pins were designed to shear and allow blades to spin at the desired burst speed.

Since burst speed was accurately controlled and weight of the blades reduced to a minimum, containment was greatly simplified.

Containment at 100% of all burst fragments was achieved with no weight increase in the turbine's housing which has a wall thickness of only .041 in. Also, no fan or other secondary burst was generated by the burst.

Frangible wheel design operating at 10,000 rpm was maximum control speed—10,000 rpm, burst speed—50,000 rpm, max operating temp—7200, max inlet pressure—250 psig.

Very high speed gas turbine engines permit flight duration of 1.2 minutes of a second with lighting frequency of 12,000 per second) show that the

wheel actually burst at 60,000 rpm.

#### STAINLESS HONEYCOMBS

Because stainless steel is more hard to draw than iron it will be more popular for the future aerospace aircraft, according to Del Eng. All Fueling Enamel, research specialist, Lockheed Aircraft Co. Since it will be used in very thin sheets to offset its greater weight, stainless steel will probably be used in sandwich forms, Enamel said.

Despite the present high cost of based on resistance welded stainless steel honeycomb panels (5190, 100 sq. ft. prior to installation), the need for the thin sheet to be installed against compression loading will encourage a great deal of experience in the art of manufacturing high temperature honeycomb structures.

A general disclaimer to the effect that use of honeycomb panels is that the panel attaching means add 40-50% of the facing weight on the otherwise efficient structure. Another limitation is that of bonding, separation and repair control. This is often so complex that out of a batch of 15 panels, only 5 may be accepted.

One exhibit was an all resistance welded stainless steel honeycomb panel by the Glenn L. Martin Co. All welded honeycombs have the dual advantage of better thermal resistance and elimination of bonding metal weight.

N. E. Pineda, Navy Bureau of Aeronautics, indicated that new ultra strong welding methods may supplant resistance welding.

Trends in very thin stainless steel sheet will encourage more extensive tests to see classical milling, L. G. Hall, supervisor, Engineering Dept., North American Aviation, and Glenn L. Martin Co. have shown that sheet metal "machining" problems despite heat treatment, difficult to control and the accuracy not to deter the past. North American has said it is likely that the type, design and construction between between honeycombs, partial mixing or welding operations on small scale tests.

#### TURBOJET TRANSPORTS

Problems arise upon the design impact's low fuel consumption was emphasized by A. A. Landorf of Rolls-Royce. However, he said that is little performance in service would easily decide which of the current transports was a competitive bid.

Frank W. Koll, American Airlines, Inc. said that the two designs having of turbojets used for certain transports would be low specific fuel consumption and risk factor.

Koll described reliability in terms of a low pounds per hour rate, which

is now leads to low maintenance costs. To put work in their engine oil, Koll said, engine maintenance might be given to the airlines, guaranteeing that the maintenance cost of operating their engines will not exceed a reasonable maximum.

Fuel consumption and mechanical maintenance account for more than half of the airline operating costs, Koll pointed out.

#### HOT DAY THRUST

Talented throat of a jet aircraft is not 10% when temperature is 100°F at sea level, according to D. W. Fisher, Boeing Airplane Co. chief of performance design, Transport Division. This means a 10% reduction in allowable takeoff weight on a specific field length.

A field length limited aircraft therefore can lose more than one-half of its design payload in hot day operations as he is able to use only half as much with a full payload, Fisher said.

These performance losses are based on a 30 deg. excess over the standard air temperature of 50°F at a takeoff speed of 110 ft.

Engineers' effects of elevated temperature operation for low-engine jet are primarily due to the deterioration of exhaust heat carrying capability, Fisher said.

At near normal temperatures or at ranges not more than two-thirds of maximum, there is no significant operational problem.

For the more normal case, he said, "in which the operator desires to provide flexibility in equipment for engine use at all parts of a large sea or air, including long range, as well as tropical, desert, or mid-continent aircraft operation, the desirability of providing some form of thrust augmentation is evident."

The Boeing official cited several engines and engines modified to improve thrust in two areas of compensating for the high temperature limit.

Two methods of augmenting an engine's thrust are by increasing engine speed for takeoff only, or by providing a water injection system.

All these solutions entail economic penalties in operating phases, Fisher pointed out. When the basic engine would break even in a 100 percent configuration with 47 passengers at 1,600 cu. mi., the overall engine would require 51 passengers, the overpowered engine, 48 passengers, and the water augmented, 49 passengers.

Fisher concluded that some means of increasing the ratio of takeoff thrust to all other thrust characteristics of a jet engine is needed, since engines need for more revenues tend to be significantly underpowered for takeoff, particularly at above-normal temperatures.



## Douglas Turboprop for Fleet

Drawing and three-view of Douglas DC-5, four engine turboprop powered in a four engine aircraft show it is similar to the Douglas DC-5 (AW No. 25, p. 10) placed in a DC-5 replacement. Though the four engine has a nose section, its overall length is 4 ft. 4 in. shorter than the transport design. Cruise landing performance is indicated in drawing below. Like a previous Fairchild proposal, Douglas contains an aircraft capable of meeting a task force at sea, reducing dependence of the base on surface logistics (AW April 1, p. 26). The Douglas turbine would use Lycoming T55 engines and would need most complicated high lift techniques in boundary layer control to maintain simplicity. High engine thrust brought into high lift flaps, moderate wing loading, would give the airplane short takeoff capability. No wing or tail folding is used. Flaps could be integrated with wing section out.





FRANCO ALPHETTE II is five-place utility helicopter powered by a 560 hp. Turbomeca Artouste II. Republic is licensed to build this design.

## Piasecki, Republic Take Options To Produce European Helicopters

Washington—Increasing U.S. interest in European helicopter designs was evidenced last week as disclosures that two companies are considering manufacture of foreign rotary-wing aircraft.

• **Piasecki Aircraft Corp.**, Philadelphia, Pa., has an option to build the Ultra Light, a five-seat, light helicopter designed by Euro Aviation Co., Ltd., of England.

• **Republic Aircraft Corp.**, Farmingdale, N. Y., has been licensed to manufacture the French Alouette II, five-place turbine-powered utility helicopter designed by Sud Aviation.

Both American companies are preparing to demonstrate their new air-

craft in military contexts, particularly the U. S. Army, which already has stated a requirement for aircraft of these types.

### Fairy Ultra-Light

Piasecki's Ultra Light will be one of a half-dozen small helicopters to be considered by the Army, which will grant about \$20 contracts for design studies in the field. First contract already has been awarded to Koffler Aircraft and other manufacturers will be asked to compete.

Piasecki says the French design has advantages in simplicity that make it possible for the pilot to do his own

maintenance. The company says the Ultra Light will have an initial operating cost about one-half that of conventional small helicopters.

Mr. Gene Houshian H. Housh, chief of Army Aviation, has said he hopes to procure aircraft of this type in large numbers for use by combat forces. One goal will be the general use of approximately one-third that of present models. The Army is trying to hold down development costs on the project, and there is a possibility that it will buy an off-the-shelf product, in which case the Piasecki design would be a modification.

### Alouette II

Republic Aircraft's interest in the Alouette II also appears to be an effort to equipping on a self-contained design to meet an Army requirement. The French helicopter would be a conversion for Army's utility requirement, and would compete with the Bell OH-40, which is also a turbine-powered aircraft.

Republic also has interest in Nivi requirements, where the Alouette II probably would be offered as an alternative to the new Sikorski HO4S II, for which a development contract has been awarded (AW Feb. 11, p. 34). Republic says the French aircraft is an efficient helicopter for an air rescue work.

In the case of both the Piasecki and Republic proposals, the foreign-designed engines will be built in this country by Continental Aviations, which holds the license from the French Turbomeca Co. The Alouette II is powered by a 365 hp Turbomeca Artouste II, the Ultra Light by the Piasecki, a Turbomeca design.

## RAF May Be Given More Flight Testing

London—Royal Air Force speedways speeded up in the last week's report when, for testing new aircraft.

This has been disclosed in the House of Commons by the Secretary of State for Air. It was suggested to him that RAF flight testing might lead not only to better testing but also to lower delays at the Ministry of Supply stage before new aircraft become operational.

Agreeing with this, he said a number of steps in this direction already have been taken, including such things as stationing RAF liaison officers at aircraft plants, the Central Flying School, and the Directorate of Flight Testing.

Even when aircraft goes into squadron service, he said, the aim is to try to fly 1,000 hours as quickly as possible and to send as periodic reports.



PIASECKI AVIATION CO. Ultra Light is two-seat, light helicopter powered by the Turbomeca Artouste II. Piasecki has option.



## This New 400 Cycle AC Rotary Actuator by EEMCO

Has an Operating Range of 320 to 480 Cycles a Minute

EEMCO Type B-422 400 cycle rotary actuator controls the leading edge flap on the latest and fastest supersonic fighter aircraft now in quantity production for the United States Air Force.

★ One of the unusual features of Type B-422 is that it operates on a frequency range of 320 to 480 cycles whereas Military Specification requirements call for a range of not less than 400 cycles for AC actuators and motors. The greater range eliminates need for a constant speed drive for the generator system in the aircraft which cuts down possible maintenance and at the same time reduces overall cost and weight considerably.

A torque limiting AC clutch is incorporated in the motor in Type B-422 which disconnects the high inertial load imposed by the motor's armature. A brake can be built into this mechanism if Type B-422 is utilized for use in space after capacity. Another feature is the adjustable non-jumping stops that are built into Type B-422 which are especially vital on an actuator with this load magnitude.

For the past 15 years EEMCO has made a specialty of designing and producing special AC and DC motors and linear and rotary actuators for the aircraft industry. In entire effort has been in this field. Reflecting the high standards of precision granted from this experience is the fact that EEMCO motors and actuators are included in the majority of the latest jet aircraft and missiles now being produced for our national defense.

**SPECIFICATIONS FOR TYPE B-422**  
 Nominal operating load: 25,000 inch pounds  
 Maximum operating load: 50,000 inch pounds  
 Operating cycle rate: 75,000 inch pounds  
 Speed: 45 degrees at 525 RPM  
 Armature: 4 amps at 25,000 inch pounds at 480 cycles per minute  
 Weight: 10 pounds  
 Qualification: Type B-422 has been designed and qualified to meet applicable military and aircraft manufacturer's specifications.



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## Canadair CL-28 Makes First Flight

Canadair CL-28 turboprop aircraft made first flight three days ahead of the schedule laid down by engineers three years ago. With William Loughrey, Canadair chief test pilot, at the controls, the CL-28 lifted off the runway at 1,200 ft. Its flight, which lasted 75 min. Second flight in test program was made the next day, with Loughrey and some crew of five aboard. Designated CL107 by the Royal Canadian Air Force, the airplane is a twin-engine version of the Berliet Indusair. Canadair will build 25 for RCAP, also plan a transport version with turboprop engines.

## General Accounting Office Asks Tighter USAF Subcontract Policy

Washington—General Accounting Office is called for a closer USAF policy on all programs in subcontracts in tests now, before the House Armed Services Investigating Subcommittee headed by Rep. Edward Brooke (R-La.).

The recommendation stems from a GAO investigation of \$135.9 million in subcontracts awarded to Ford Motor Co., Ford Motor Co., for 8-17 being with Boeing Aircraft Co., Douglas Aircraft Co. and Lockheed Aircraft Co. The investigation found after reevaluation was 9.4%. Under the actual operational costs, there was a profit of 16.6% in 1975, more than an expected, according to L. J. Powers, director of GAO's Defense Accounting and Auditing Division. Powers and Ford made a voluntary commitment to refund \$3 million to USAF despite the fact that Boeing was reluctant to make a new reevaluation of its contract.

USAFF promptly protested the tests were which, it said, "implied that the Air Force should not contract in securing a \$5 million voluntary refund to the Ford Motor Co."

In a letter to Robert, Secretary of the Air Force James Douglas and Ford have declined to make a refund on being informed that USAF considered its policy correct.

Douglas and it was only after USAF "insisted" that Ford agreed to a \$5 million refund.

In the end, he said, a \$3.5 million return was made to Boeing, Lockheed, and Douglas after deduction of a credit for test operations on facilities due Ford was made from the \$5 million.

Powers charged that the economic Ford profit "resulted chiefly because reevaluation was made before sub-

contract production expansion and related costs had been obtained and that direct control by the Air Material Command over price reevaluation in this case would have resulted in a more equitable price."

He quoted AMC as saying that Ford's refusal "will not only make up for the apparent error in negotiation but will also provide an Air Force during in the companies due controls to Ford efficiency." Powers added that AMC's explanation "contains no belief in the need for closer supervision by USAF of approvals of major sub-contractors."

"We do not suggest that USAF assure price contractors' responsibilities for conducting ongoing negotiations, but since USAF does have a direct interest... we believe USAF should ensure that the joint contractor fully protects the interests of the government."

Powers also urged that "significant voluntary price reductions from its sub-contractors by prime contractors should be passed on to the government."

On the first, Secretary Douglas told Rep. Brooke that the refund agreement with Ford provides that "no increased profit... would accrue to any of the aircraft contractors involved by reason of any contractual arrangement for sharing in cost reductions."

## News Digest

Miss Safety Appliances Co. and Gulf Oil Corp. will undertake joint program in high energy fuels, which

will be carried out by Gulf, General Co. Office is building plant at Manassas, Va., for "HGA," a hydrogen-oxygen fuel for Navy.

Canal Steel Co. will continue development of new high temperature steel for an aircraft USAF received contract for program, which includes a study of turbine steel and of metal-hydrogen properties of burning fuels for high temperature aircraft use.

Aircraft-General Corp. and British firm of D. Napier & Son will exchange technical information on liquid fuel rocket engines, covering an high test power engines.

Lockheed production pilot E. C. Pratt tested from an F-104A SC-71 fighter into Edwards AFB last week, after the engine failed on.

Japanese Defense Agency first first guided missiles in tests, aimed at domestic targets, in 1964. Japanese and Nike type missiles in 1960. Japanese test missile, the TMB 98, hit speed at Mach 4.

Lockheed C-130 Hercules took off at 111,000 lb. gross weight during tests at its landing gear system on new covered base at Beaufort, Maine. Test Force SLICED (new, land and sea deployment exercise) was engineered by Wright Air Development Center.

Glen L. Martin Co. for \$6,011,930 contract for 485,000 sq. ft. plant at Orlando, Fla., where Lockheed made a new production. Test buildings of plant will include manufacturing, engineering and administrative offices.

French carrier Dismale left France with 13 Douglas and 13 Mirage IV fighters for India. It was first Mirage IV delivery to India.

## AIR TRANSPORT

# Decline in Overshoot Crashes Reported

Reversible propellers help trim runway crashes; new miss reports remain at dangerously high level.

By L. L. Doty

Washington—Slating decline in crashes caused by overshoots, but two as tall as the use of reversible propellers, increased pilot competence and better cockpit training. Modern cockpits, however, remain a serious threat. An average of 3.7 miss errors are reported daily.

A report released last week by the Civil Aeronautics Board shows that 75% decline in the frequency of overshoot crashes per mile (miles) was recorded during the period between 1950 and 1957 from that of the 1946-1949 period.

In each of the 38 overshoot accidents reported, the aircraft was either destroyed or sustained substantial damage. Only two of the aircraft involved were equipped with reversible propellers and a smaller one was the reversible motor aircraft found to be faulty.

Non-continuous reports CAA with the CAA between Sept. 1 and Dec. 31, 1958, were dangerous, high, taking 412 and 100,000 ft. respectively. A total of 129 passengers aboard the flights involved.

No comparable statistics for previous periods are available to indicate either a rise or fall in the number of overshoot crashes.

However, the Board reported last week that 226 passengers lost lives in 127 overshoot accidents between 1946 and 1957 (AWW July 26, p. 12). An additional 125 people were killed in the collision of United and Trans-World aircraft over Grand Canyon last June.

### Non-Miss Analysis

How are the facts brought out in the CAA analysis of the new miss reports filed?

• **Vigilant Flights** associated by 22% of the 542 miss reports filed, were flights by 795. Of the latter group, 85 were filed by scheduled airlines.

• **Total of 4%**, or 99% of the incidents occurred in controlled or open • **VFR conditions** prevailed in 144, 76% of the cases, 121, 72%, of the incidents came during daylight hours.

• **Majority of deaths** in overshoot crashes, although 13% of the reports involved head-on strikes. Out of 38 of 20% of the reports revealed overriding approaches, which indicate that the type of flight was associated CAA's Technical Development Center

has found that the greatest danger of collisions lies in overshoot accidents because of cockpit blind spots (AWW Nov. 5, p. 10).

• **Analysis of the incidence of a miss** between 500 and 2,000 ft. in 136 cases and between 200 and 500 ft. in 124 cases. There were 19 incidents in which the threat was first noted within 300 ft.

### Danger Zones

Most of the incidents occurred while aircraft were on route in controlled airspace at altitudes between 4,000 and 15,000 ft. Below 4,000 ft. and above 15,000 ft. were the threat areas.

A total of 172 pilots reported a near miss in descent or arrival operations at airports with control towers. A total of 180 of these aircraft were flying below 1,800 ft. and of the group, 71 were flying within a speed range of 200 mph.

In 143 incidents reporting pilots did not observe the other aircraft before the danger of a near collision was evident. In 78 cases, the pilot reported he saw the aircraft prior to the danger of collision but did not do it at the last moment.

In 121 cases, the aircraft came to within 300 ft. of one another. In another 232 instances, aircraft came to

within 300 to 900 ft. of one another. Nine cases involving only pilot error were reported for 204 of the reports. In 70 cases, pilot error and jet aircraft were involved; 101 cases were reported by 101 pilots. Helicopters were reported in three near collisions. Reversible propellers and their use in able to take corrective action in 131 cases, in 51 incidents, pilots said engine as two miss impossible.

### Overshoot Decline

The CAA report on overshoot landing accidents underlines the effectiveness of propeller pitch in controlling this type of crash.

In one of the two accidents in which the aircraft involved were equipped with reversible propellers, both landed on a Lockheed L-1049 and shortly thereafter were on the ground at the overshoot. The aircraft plowed through a boundary fence and across a highway before it came to rest in a right position. None of the 14 persons aboard were injured, injured.

In the other accident, the one involving a Boeing 577 Stratocruiser, an active reversible propeller might have prevented the overshoot approach.

Touchdown was made about one quarter down the runway. Unable to decelerate the ground roll, the pilot made a slight turn to cross several hundred feet of runway area before crashing into a chain-link fence, causing substantial damage to aircraft but only minor injuries to two of 46 passengers. At touchdown, the pilot experienced a hard shock when the throttle was moved into the reverse quadrant and immediately put the throttle into forward idle position. Brakes were in effect.

Later investigation revealed that the exact location of the propeller reverse system was in the "mid" or in reverse position, resulting in a hard shock. Further study indicated that the exact location was pulled during a prior flight and was not reset prior to the accident.

The 21 overshoot accidents included 11 DC-1, eight C-46s, seven DC-1 to two L-1049s and one B-47. In addition to the Boeing and Lockheed equipped with the reversible propellers. "Reports of the incidents occurred during a winter month, and 23 took place during daylight hours. Runway conditions were wet, dry or snow-covered in 28 of the accidents.

A total of 71 factors were attributed to causes of the accidents. In 24 cases

plots were charged with landing too high, too fast, too far down the runway, or with improper altitude planning. Co-pilots were held responsible in six cases, and other personnel were charged with error in those instances.

Brake failure was responsible for only one overshoot accident which was the cause of three accidents. These include failure of crosshairs, front tire failure and bearing and propeller blade in flight.

### Propeller Failure

Propeller failure in flight was the cause of one overshoot accident which might have been prevented by reversible propellers.

A Lockheed L-1049 experienced a malfunction of its propeller system during a low-level climb out of Los Angeles and both engines were feathered. Near the time the engine feathered but failed to develop more than 1,800 rpm.

An instrument approach was made at Long Beach and the aircraft passed over one half the runway before making a touchdown. Brakes were ineffective on the slippery runway and without the aid of reversible propellers, the aircraft skidded 1,400 ft. from the end of the runway before the right gear collapsed to stop the slide.

Weather was generally unfavorable in most overshoot accidents. In 27 cases rain, snow, mist or fog prevailed. Visibility was less than two miles in 17 instances and prevailing ceiling at the time of the accident was under 2,000 ft. in 22 cases.

In no case was insufficient runway length attributable to an overshoot accident. Trends in the number of crashes reported on runways 1,600 ft. in length or more.

## Convair Offers Japan License to Build 440

Plans to build the Convair 440 in Japan are under study by Japan Aircraft Manufacturing Co., a subsidiary of Japan Airlines (JAL), and requires a requirement for less than 100 aircraft to be 1960 to replace DC-10s now in use on its domestic routes.

For commitments for an additional 40 aircraft can be obtained from the Japs now Air Safety Defense Force, it is considered essential to manufacture Convair 440 aircraft in Japan.

Convair's proposal for licensing aircraft manufacturing to JAMCO includes rights to sell Convair 440s to other JAL Eastern countries, but Japanese delivery would not be reported before 1960.

The Japanese domestic market is not considered as a domestic requirement. Mitigating against acceptance of the Convair proposal may be the Japanese trading public's preference for four-engine aircraft, according to a JAL representative.



NOSE SECTION of first Boeing 707-120 Stratocruiser, destined for Pan American Airways, is lifted from jet at Kansas, Mo., plant. It will be delivered late next year.

## First PanAm 707 Under Way



SECTION 42, being lifted from jet (below), is placed in nose section (below).





# Soviet Passengers Wait, Wonder, Freeze

By N. Kloviz



RUSSIAN-BUILT IL-14 with Chinese Communist airforce markings seen by its pilot at Kunming. Kunming is terminus of rail routes to Southwest China and its traffic to and from Southwest Asia. Flight operates twice weekly between Kunming and Singapore.

## Kunming Is Chinese Southeast Asia Terminus



MECHANICS repair IL-14 at Kunming (left). Tail of IL-14 flight frozen terminal building at Kunming.



MECHANIC, using chopsticks, is tail of Kunming. (Center) tower operator (right) at Kunming talks with aircraft in flight.



**Moscow**—The ordinary scheduled airline flight is not devoid of a certain amount of romance. Even so, passengers can't help but be bothered by such trivial and seemingly unimportant problems as the plane's departure time, transportation to the airport, the order of waiting in the plane, known time on route, etc.

Our itinerary was Yenkiere Airport (Moscow) to Khabarovsk on Flight No. 3. Date and time of departure were (on 16) at 4:25 a.m. The bus from Yenkiere Square left at 3 a.m. To remember these figures:

The passengers for the flight gathered at the Sverdlov Square bus stop at 3 a.m. That's no mistake. We all crowded together on a long line (short on hand before the bus departure time. Why? It is possible that the passengers themselves decided to go to Yenkiere for just so long before the departure time!

Not at all. The busmen are selling tickets after landing out with the ticket "Passenger Handbook" which said that the bus left for the airport at 3 a.m. The passengers, naturally, were tired with the problem of when to be late. They believed the handbook and, as a result, they adopted a whole hour at 3 a.m., the bus left.

The small post-flight hours provided at the terminal. View and then the loudspeaker announced plane arrivals.

For passengers on Flight No. 3 had to spend about two hours at the airport. One could wait away the time visiting airplanes as spectators in the observation room. However, one had to bring one's own reading material with one. The terminal is situated close at night even though flights are made around the clock.

### Departure Delay

The first hour after boarding an airplane. However, for some reason the loudspeaker announced when people began to get services. After the packing question: What's wrong? Could there have crashed the plane?

Passengers headed for the kitchen too hungry. There it was explained that the plane would leave at 4:35 a.m.

From me, and one of the passengers "It says on the ticket, and we were told at the city ticket agency that..."

But what does it matter what the ticket says. Departure for Flight No. 3 is scheduled for 4:30 a.m., and it must leave only at that time. The ticket agency said that the plane departed at 4:35 a.m. reviews on the ticket agent's conduct.

Then we waited but yet another

### Aircraft Critique

Critical survey of an "ordinary" aircraft flight from Moscow to Khabarovsk which began on the page was translated as follows: Work item. "Cautiousness Aviation" the state-owned airline's official magazine. The author, N. Kloviz, is described by the magazine as a "special Aviation representative." Author criticizes the airline's handling of passengers. Both in the air and at Soviet airports, also have appeared recently in the Moscow daily press.

improve. Twenty minutes before boarding time we were needed into the terminal office. Thus we were told that today Flight No. 3's schedule had been changed to include a night stopover at Ulan-Ude.

Without further explanation we were loaded into boarding steps. The passengers crowded into the narrow and hurried to the gate. But then it turned out that on this particular occasion loading for Flight No. 3 would take place through the freight room. So we had to return there.

### Rail Cell

We went out on the platform. Before taking us on the train, the late attendant loudly called the call and suddenly discovered that two passengers were missing. She then left us and ran to the terminal. We waited.

Finally she appeared again, the attendant the passengers and led us to the plane. We checked the steps and were re-arranged over some. The late attendant again ran to the terminal. In a few more minutes, waiting and waiting, the flight back to the plane, concluded in for the third time, we had to board, and left.

Also, there were still two people missing. Looking for all indications, they had been somewhere outside as the passengers left.

The engine started. The IL-14 transport No. 11733 rolled along the air strip and out onto the runway. It accelerated there a little while, then started moving, gained speed and effectively left the ground. We were off.

The flight went along smoothly. We would have liked to thank the pilot for the good takeoff and for the lack of bumping. But, and it is nice to know who is piloting the plane now are asking. One could think that since they've been up a good while now had down. Before each flight, the plane's captain must greet the passengers, tell them who is to accompany them over, give them some information on the coming trip and

show them if the facilities aboard the aircraft.

The directive was posted in the subdivisions. But in many cases it hasn't been complied with. One it is that the pilots remember to drop them for them to become acquainted with the "passenger."

Down began to look... The earth could be seen through rifts in the clouds. The plane descended and made one landing.

A violent jolt in a dark blue dress announced.

"Comrade passengers! We have landed at Sverdlovsk. There is a new hour stop."

It turns out that we had a better in our plane. We had mistakenly believed her to be just another air travel. She hadn't given me satisfaction of who she was, well looking at Sverdlovsk.

The plane turned to the terminal. The stern was rolled up to the door, and a lady attendant climbed up.

"Good day, comrade! Your plane has landed at Sverdlovsk," she said. "This will be a stopover of about two hours."

But they just told us that the stop is for one hour, and one of our companions.

The accompanying was explained. The inevitable called for a landing at Krasnoyarsk. But because of poor weather we overflew Krasnoyarsk. Therefore the Sverdlovsk stop was extended on time. The lady attendant said that the flight was on time. Further on, at Omsk, we discovered by personal experience how important it is to have precise information about such a "little" in the duration of a stopover and to understand airport.

### Seaside Terminal

We boarded for the so-called. Outlets, the landing's inside made little impression. It was good to get away with out my special statement that made it was different. The first thing that strikes you is the questions and comfort. Everything is clean.

There is a restaurant to the right of the entrance. To the left are a large hall and waiting rooms. In the waiting rooms are tables with the newspapers and the newspapers in particular. In the second waiting room is a kiosk that was open and doing a good business in newspapers and magazines despite the car's heat. The waiting room had many chairs for passengers waiting their planes.

The restaurant setup was also good. Waitresses leaned up in room in a passenger set at a table. The food was served quickly.

The buses were good, and the drivers were trouble-free.

One immediately compared the operation of passenger services here in



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Swedlow, with that at Vankov in Moscow. It must be said that the core parties feared Swedlow. It would seem that this is something for Cosmo Zepherin, the Vankov Airport director, to ponder over.

### No invitation to Terminus

Again we were in the plane. The next stop was at Oad. The lady at Terminus of the air terminal reported that a 10-minute stop was scheduled. We weren't invited to enter the terminal. They told us that it was too far. We got out onto the long field. A cold wind was blowing, and we decided to spend the time in the plane.

There was a crew change at Oad. Our ladies revealed from the plane a container of fruit, drink, dehydrated bottles with hot tea, and boxes of cookies and jam. Thus we learned for the first time that we could have gotten out when drinks should be given. Now it was too late.

Everything was taken off unattended at Oad. Only one passenger stood by a handful of water, showing at the time that he had wanted something to drink during the entire flight from Swedlow.

Well, here was a good place to turn up the first stage of the flight because we took leave of the crew that had brought the plane to Oad. But just as there had been no introduction at Vankov so there was no goodbye at Oad.

The captain and other crew members slowly left the plane and headed for home. Even at this belated time we tried unsuccessfully to see a few words of farewell to them. The fact that the three captains flew his craft skillfully kept his crew busy and made good breakfast and through dinner all days of appeal.

### Neglected Captain

But, at the same time, Cosmo Ethen, the plane's captain, remained neglected attention toward the passengers. His lack of regard for complying with use of the most important rule of flying the cabin was intolerable. Introduction of the crew to the passengers is not a trifling matter. It is an obligation of the most important rule. Cosmo Ethen also failed to tell us that the rest of the crew did it very precisely. He was doubly responsible for the fact that the stewardess, Cosmo Ethen, didn't carry out her duties during the flight.

The time to leave Oad approached. But there was no sign of any aircraft departure. We didn't even leave the plane a few feet and came out to the plane. Meanwhile, landing and unloading went on. The plane's doors remained wide open, and the stewardess, which was getting ever colder, went into the cabin. Along with us, other passengers, I decided to go to the

air terminal. We noticed that there was a certain amount of risk in our decision—while we were getting warmed up the plane might have

In the terminal, we looked for an information officer. They sent us to the ticket counter. Nobody was there. Finally, we discovered a door on which a little sign was hanging. It said "Club of Transportation Section." We went in. At the desk sat a woman who was smiling in deep concentration. We interrupted her and asked how long our plane would be staying at Oad. He abruptly turned his gaze upon us, picked up the phone and called the dispatch.

"Trunkhouse (speaking) How much longer at Oad? I want to be here at 10:15. Oad Twenty minutes more," he reported to us.

### Restaurant: No Admittance

Twenty minutes isn't a long time. We had to get back to the plane. On the way we tried to stop at the restaurant to get some bread and butter. But we weren't admitted to the restaurant if you are wearing your uniform clothing.

We asked that a waiter be called in at once. There wasn't time to get out of our coat, gloves, sweaters, etc., and then put them on again at the 20 minutes we had left and still cover the considerable distance to where the plane was parked.

On the way to the plane, we were met by the lady terminal attendant. She suggested that we hurry since the repairs would be started right away. We hastened our steps.

The plane was now just like it had been when we left it. But the passengers remained themselves in the expectation that it would be only two or three more minutes before it would be everything would be all right. Ten, 15, 20, 30 minutes went by. Only after 40 minutes did the repairs start.

And so it was that we didn't get away until after the "hard stop" at Oad until we reached Novosibirsk (400 miles to the north). This allowed didn't bother Cosmo Trunkhouse much. This was the only paper work we were required to do.

Meanwhile, the plane captain who replaced Cosmo Ethen also didn't consider it necessary to introduce him to the passengers. However, this neglected attention toward carrying out one of the most important rules of passenger service was typical of the personnel on Flight No. 3. One would like to see Cosmo Trunkhouse, chief of this subdivision. "When are you finally going to take seriously your responsibilities of complying with Airline's directives regarding the treatment of passengers in flight?"

Things were also the same when the

change of stewardess. In one case, the stewardess didn't get on to the fact of Cosmo Trunkhouse, the crew member responsible for taking care of them. In all probability, the same plane captain, Cosmo Trunkhouse, the Cosmo Ethen, didn't feel responsible for the stewardess' work.

### Hostile Waitress

We arrived at Novosibirsk in the evening. Here also some unexpected news awaited us. First the restaurant was closed. The first flight No. 3 came in. Then explained that we weren't just at the time the restaurant was being cleaned up and a crew member shift was coming on.

Indeed, some of our fellow travelers succeeded in "breaking out" the restaurant. A waitress met them hastily and demanded that they hurry, with their orders because she was trying to get home. When they served our drinks, it became apparent that other restaurant personnel shared the waitress' uncooperative attitude.

The waitress was very attentive to the passengers. They didn't even have the food to normal temperatures—let alone make it taste good.

The formal waiting room was dirty and cold. The attendant was looked up. Besides the attendant, there was a buffet stand which there was another a smelly crowd of people in a room unattended with an transportation. This was because the food at the time was in the restaurant.

Only two or three years ago, some of the members of the crew spent in maintaining the Novosibirsk air terminal. The Novosibirsk air terminal was a Soviet Siberian Administration didn't spare expense in providing gift trays, expensive smoking, cigars, etc. But all this came to a halt because of the Novosibirsk air terminal was transferred to the passengers.

### Krasnoyarsk Ground

At last, the baggage claim announced that our plane was ready for boarding. We walked to where the crew was parked and saw that the stairs had been moved to one side. A truck was against the restaurant door, so the passengers got out into the plane. We stood and waited.

The Stewardess could make itself felt. The last attendant flight suggested that we wait in a nearby restaurant. It can't be said that it was as perfect as the first, but, even so, it was better than being outside.

Krasnoyarsk is again behind us. In the next 20 minutes, although our time was long past, we sat down at the restaurant table with pleasure and no health. Special tickets were sent and for passengers on scheduled flights. These tickets are given pretty much



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The waitresses were affable and efficient. The waiting room was also very nice.

We flew on to Istanbul during the night, arriving precisely on schedule.

Here we can end our travel notes. Undoubtedly other flights are better or poorer and the service is more efficient. But even if we concede that all of our troubles were the result of happenstance, one may still be so bold as to say: "Weren't there an awful lot of air lanes before for one flight?"

## SHORTLINES

► **Aeromex** plans to stop at Puerto Rico instead of Bermuda on its cross-sea Super-C-119 service to Mexico from South America and Europe. Colombia carrier's route change, which would be effective in May, is subject to CAB approval.

► **Foto Rullo** C-46 conversions have been ordered by Western Transport, Seattle, according to Rullo. Airlines use its transport category conversions under new rules.

► **Northeast Airlines** put its second DC-6B into New York-Miami coach service on March 25. First carrier 70 passengers in two-class seating and lounge.

► **American Airlines** has ordered RCA weather radio for its DC-6 and DC-6B passenger planes, also for its DC-6A cargo aircraft. DC-6As are already equipped.

► **KLM Royal Dutch Airlines** netted \$6 million last year, a 37% increase over 1955. Total revenue was \$137.5 million for the year. KLM's 1956 capacity totaled 294.2 million ton-miles, and load factor was 80.5%, up from 58.5% in 1955.

► **TWA** called into to fly the New York-Boston route at night during first week of March, according to its technical Air Transport Association. TWA's route was worked less than five years after launch service began on the route. IATA statistics gave New York-TWA-Miami via route, under 40, earned \$7,000 or less, and never flew before.

► **New York-Boston** meeting was made by British Britannia in 12 hr., 22 min. at average speed of 382 mph. The 150 turboprop departed London in 170 180 D. time, arrived at 25,000, ended "long stage" but consumption test with fuel for 150 miles of flying. Fuel used was 10,000 lb., including 400 passengers.

## AIRLINE OBSERVER

► **Airlines** will intensify their campaign for the abolition of 30-the-pylon fuel laws as a result of the pending increased rate of fuel consumption in the operation of turboprop and turboprop transports. Capital Airlines, which has the scheduled pylon at rate laws with four Vanguards, and that experience a heavy volume of fuel to face the abolition of the pylon. Current target of the pylon law fight is Airlines whose service ends per pylon of gasoline, kerosene and other fuel is highest in the U.S. Airlines' legislative committee in May, and the airlines are hopeful that of reaching at least a compromise extension that may not prevent them to as little as one cent per gallon.

► **Boeing** Airlines mechanics voted International Assn. of Mechanics in their bargaining agents in place of the Air Carriers Mechanics Assn. in a recent National Mediation Board election.

► **Rolls-Royce** Dart turboprop engines have recorded over two million flying hours of scheduled airline operations, one-half of which was accumulated in North America.

► **Western Airlines** will introduce its Lockheed Electra turboprops on its newly-opened Los Angeles-Memphis City route.

► **Corvair** has placed orders for more than 31.2 million of heavy machine tools for use in the construction of the 580 jet transport. Capital funds for an additional 52 million worth of heavy tools and other special equipment will be ordered shortly.

► **Air Traffic Control** Assn. has protested to the Air Line Pilot Assn. over the manner in which ALPA's council cross-commissioned controllers while taking depositors in connection with pending Civil Aeronautics Board proceedings involving alleged violations of air traffic regulations by Capt. Leonard Specht, TWA pilot (AWN Mar. 18, p. 30). ATCA claimed controllers were cross-commissioned as if "they were black, adverse witnesses in a criminal prosecution" and were not treated "with the consideration to which witnesses are entitled, who merely try to present objectively the facts about which they are questioned." (See page 34.)

► **American Airlines** will incorporate its flight department to select top-level management members from course data, as planning procedures and policies for the introduction and operation of turboprop and turboprop transports. The program calls for departmental direct-representation through the establishment of local regional flight offices. Divisions within the department headed by T. L. Reed, vice president-flight, or Flying Operations, Dispatch, Scheduling Service and Communications and Administrative Services.

► **Capital Airlines** will report a passenger traffic increase of 65% for the first quarter of 1957 over the first quarter of 1955.

► **Trans Canada Air Lines** began the last scheduled airline in North America to drop the requirement that non-scheduled be registered routes. Most airlines discontinued the ruling during World War II because of the short age of routes.

► **Continental** will rule out purchase of the Scottish Aviation Twin Power because of the aircraft's single-engine performance. Short-field performance of the STOL aircraft has been exceptional during a three-month test period but Swiss mountain airports are too high to have comfortable reserve of altitude with one engine out.

► **United Airlines** increased aircraft utilization from 7 hours, 8 minutes in 1955 to 7 hours, 16 minutes last year, an increase of 7%. Utilization of the DC-7, which represents one-fourth of the airline's carrying capacity, increased 18%.

► **North Central Airlines** plans to increase flights on its Wisconsin route segments as a result of a petition by the Chicago and Northwestern Railroad to discontinue 31 daily trains on its runs between Chicago and Madison, Milwaukee and Minneapolis-St. Paul.



Another reason why G.E.'s newest turbojet makes possible

the ideal medium-range jetliner



1923—General Electric's Dr. Stefan Moss successfully devised a way to burn pressurized fuel in a chamber, save energy to drive a turbine wheel.



1918—General Electric developed the first successful turbojet engine, based on Moss' gas turbine station. Dr. Moss (left) stands with USAF pilots who conducted tests.



1927—TWA plane proved turbojet could be used in aircraft for higher, more economical flight. Meanwhile, G.E. began its first turbojet studies.



1940—First U.S. jet, the J-1A, was developed by G.E. from British design (at USAAF request, G.E. shifted turbojet project for duration of war).



1940—Jet Age begins in America when Bell P-59A—powered by two General Electric J-1A turbojets—flies at over 410 mph in initial flight at Murray.



1944—To permit high-altitude bombing of Axis, G.E. built thousands of turbojet for B-17, B-24, and B-29. Meanwhile, company engineers worked to perfect new jet engines.



1948—USAAF's first operational jet squadron (Lockheed P-80 "Shooting Star") flew with General Electric J31s, but centrifugal-flow jets G.E. built.



1950—General Electric's axial-flow J47, installed on F-47, F-48, and B-36, became America's most-produced turbojet. From 1947-'51, more than 31,800 J47's were delivered to Armed Forces.



1952—40% more powerful than the J47, the J73 jet engine was revolutionary in design, incorporating many new features for superior performance.



1956—40% more G.E. progress in reducing engine weight and improving performance was typified by T56 turbojet engine. T56 is now being tested on Sikorsky HO4S.



1954—The world's most advanced jet engine—the J73—today powers the world's fastest fighter, the F-104A, and first U.S. supersonic bomber, the B-58.



1957—General Electric's new CJ-805 for medium-range jetliners, besides the arrival of jet travel for all America. Boeing will enter airline service in 1960.

## When you use General Electric's CJ-805 you benefit from 54 years of gas turbine progress

First, General Electric has more jet engine experience than any other manufacturer. As a result, the new General Electric CJ-805 offers benefits no other powerplant can match in medium-range operation. The CJ-805 gives you—

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For more information as to what the CJ-805 can offer your medium-range jet transporters, see below. General Electric Company, Cincinnati 25, Ohio.

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# MISSILE ENGINEERING



MISSILE site proposed by Ballistic Launch Handling includes building housing precision machinery for rapid assembly and checkout of large subassemblies and components, and reduced hours cover for final assembly. Ballistic leads to subproject launching stand.

## Launcher to Weigh Missile, Test Thrust

By J. S. Butz, Jr.

Waltham, Mass.-inspired ground movement for testing and launching heavy ballistic missiles has been proposed by the Ballistic Launch Handling Corp. Proposal includes a new launching platform that provides most "zero control" of missile movement and weight or test attitude before take-off to improve missile accuracy and reliability.

Weighting system of launcher precision is an integral part of the launcher. Weighting units are two-page load cells and the complete installation is accurate to  $\pm 1\%$  in the range between 90% and 100% of maximum missile weight.

The second process in weighing heavy bodies contributes significantly to improved missile accuracy, as inspection programming is only as good as missile weight data.

Weighting system is only one element of the new launcher, which is extra mounted to measure all of the forces acting on the missile until the instant of launching. From this information, which is displayed visually, the launching unit has a positive check on launching weight just before light-off. The Ballistic launcher then holds the missile while the rocket motor is started and run up to full power.

Thrust is measured by the launcher and the crew can observe the thrust

building in its entirety. If there is any sign of improper operation, or if the thrust falls in reach tolerances, the motor can be stopped. If the rocket operates properly the missile is released at once.

The thrust will reduce the number of accidents in which a missile motor can discharge enough power to lift it a few feet in the air. The weight then settles back to the launching area and explodes. Douglas "Thor" ICBM gas fired in this manner recently (AW Feb. 4, p. 54).

The Ballistic launcher also provides information concerning any elements (tendency to pitch, yaw or roll) caused by unbalanced thrust or wind loads. This data is fed through a servo loop into the missile control system, which can correct for these moments before release and prevent any abrupt maneuvers in the missile.

The data is fed through a servo loop into the missile control system, which can correct for these moments before release and prevent any abrupt maneuvers in the missile.

The value of such a system would be materially increased during launching operations from a moving vehicle such as a ship. It could prevent instantaneous a complete picture of the launching force and moment due to the rolling, pitching ship was not passing to the missile. The missile control system could monitor these moments or the missile could be returned until the moments passed through a zero point and then fired.

The Denver Division of the Martin Company has purchased the Ballistic launcher for use with the ICBM Titan. Second major projects include Thor and Vanguard and a less sophisticated Ballistic version employing the weighing unit alone.

The precision achieved with the Ballistic weighing units is not easily attained outside the launcher, but it is essential if the launching ballistic missile is to be effective. ICBM accuracy, by estimate, must approach  $\pm 1\%$  (plus or minus 5 miles in 1,000) if target destruction is to be certain. Two or three per cent error in weight can invalidate the trajectory programming. Indeed, it shows the controlled position of the missile flight. Worst situation even when fuel and oxidizer weights are not measured is greater portion and several hundred pounds of unbalanced control system in the missile.

The case and weighing system provided by the Ballistic unit mounted on the launching stand have never been equaled by any other method, company says. Presumably extra missile weight was determined from the tabulated weight of every item which went into the missile frame. Propellant weight was obtained from temperature correction charts after measuring the volume of the liquid placed around the missile. Launching weight was then a computed value whose accuracy was influenced by a tank collection, temperature error



SELF-PROFILED test assembly (lower left) contains equipment for fast pre-launching checks and others used to continue in pay weather. Subproject launching stand (right) facilitates placement of the missile.



ness, and laboratory test weight records.

The system of weight checking checks could not be accurate to less than 1%, which was required. The Ballistic units now make continuous weight in launcher available until the moment of launching. Missiles weight fluctuates considerably due to the large quantity of low temperature oxidizer aboard. The oxidizer bath now rapidly under atmospheric conditions.

Requirements for an efficient site as either directly related to the light of several years experience, facilities which are being planned and built now will have to test and launch substantial quantities of large ballistic missiles which will be available a few years hence.

The rapid and economic checkout of missile systems and components will be attractive if cost involved.

Tooling-up and checkout for the rapid assembly and calibration of heavy equipment which has been developed is a economically competitive industry will be of considerable benefit in assessing this position.

Ballistic Launch Handling's approach for supporting missile sites down through proven techniques for assembling and checking out large precision industrial machinery. Its experience has been gained through years of successful participation in producing accurate, consistent tanks made entirely for launching, weighing, and calibrating the output of heavy industry.

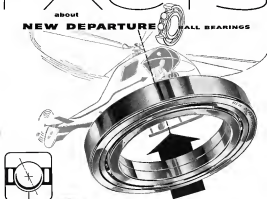


NEW TYPE launching stand improves missile accuracy and reliability by providing close control in the final seconds before firing. Stand measures thrust, weight, and any disturbing wind or movement from both. Carry-away driving shows thrust-vector and simulation which results from low-speed wind tunnel balances. New body now recovered by stress-free load cells.

# FACTS

about

## NEW DEPARTURE BALL BEARINGS



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## AERONAUTICAL ENGINEERING



**RUSSIAN BEAR** long-range bomber, fitted by NG-17 fighters, has turbojet engines which develop 12,000 hp.

### German Deportee Describes Bear Engine

General—The 12,000-hp Type K turbojet that powers the four-engined Russian Bear long-range bomber is the final result of a five-step program that began 11 years ago in Koblenz on the Rhine River.

Developed by German engineers at Junkers and BMW, the power engine produces 3,000 hp, plus auxiliary thrust at 1,070 hp per square foot.

Specific fuel consumption under these conditions is 0.152 pounds per horsepower hour.

#### Single Speed

The Type K turbojet is a single speed engine with a 14-stage compressor and a five-stage turbine. The core burner chamber is a gas-turbine type containing twelve individual burner tubes in an annular combustion chamber layout and construction is quite conventional by contemporary standards.

It is based to large measure on the comprehension of advanced German engine under development in the latter months of World War II. Most and variable stages are used.

Maximum diameter of the engine is 45.5 in. and length is 19.6 ft. Operating speed is 5,250 rpm. Dry weight without the variable stator poppet is just under 5,100 lb.

See level setting of the engine is 12,

000 hp, plus 2,510 lb auxiliary thrust. This gives a sea level power to weight ratio of 2.4 based on shaft horsepower and a power per unit of frontal area of about 1,070 hp per square foot.

The last design details of the Type K turbojet were presented in a lecture by one of the German designers, Dipl. Ing. F. Brander, at the Institute for Aerodynamics of the Federal Technical High School, Zurich.

Brander was one of a group of about 200 engineers and technicians gathered from among the employees of the Junkers and Messerschmitt Motoren Werke and deported to Russia in 1946. The group was set up as the Junkers Collection at Kuznetsov and began the five-step program that led to the achievement of the Type K engine about eight years later.

#### Report on Lecture

This article is based on a report at Brander's lecture that appeared in the Technical section of the Neue Zürcher Zeitung, authoritative Swiss newspaper. The design outlines cover power units with outside diameter from 29.5 in. at the first stage to 24.9 in. at the 14th stage. Propeller velocity is 1,666 ft. per second at operating speed. Ratio of hub to outer diameter at the inlet is 0.4515, the Germans reported.

As mean throughput is 137 lb per

second. The pressure ratio across the compressor is 15 at altitude and 9.5 at sea level.

Overall adiabatic efficiency at the design point is 88%.

Combustion chamber inlet velocity is about 164 ft. per second and the velocity at the exit of the chamber is 475 ft. per second. The pressure loss across the burner is 3.5% and the combustion efficiency is 96.5%. Life of the burner section is between 500 and 100 hr.

The complete assembly weighs about 97 lb.

#### Inlet Temperature

Turbine inlet temperature is 1,150 degrees Kelvin at altitude and about 910K at sea level. Five stages are used, with a constant outside diameter of 22.5 inches. Hub to tip ratio is 0.85. Overall adiabatic efficiency of the turbine is 94% at altitude.

As auxiliary gas turbine attached to the compressor casing is used to start the engine. The little unit has a radial compressor, a spark combustion chamber, a turbine and reduction gear. It develops 65 hp, weighs 131 lb, and has a diameter of 11.8 in. and a length of 20.7 in.

Compressor efficiency is 86% and the turbine efficiency is 93%. Poppet for the fuel installation

was Russian developed and of good overall efficiency. Efficiency here was in the order of two or three seconds.

#### Project History

Russians had been working on the design of a jet engine with an air throughput of 112.5 lb. per second when the war ended. The first job assigned to the Janssen Collective was the development of the Janssen 012 turbojet engine, which had been designed during the latter months of World War II.

The prototype had a thrust and a specific fuel consumption of 1.66 lb. per pound per hour.

When jet engines reached the bank in 1944 and the DMYF 201, were taken to Russia as souvenirs but were never developed in large numbers in production. These essentially primitive prototypes were used in design studies and larger and more advanced engines were available.

The 012 turbojet had a 12-stage compressor and a pressure ratio of 4.5. The air speed was 132 ft. per second and the operational speed was 6,130 rpm. Engine diameter was 46.7 in.

#### Need for Starting

One of the first things learned during the development work with this engine was the necessity of strong bleed for starting. The combustion chamber was a departure from the usual German pattern.

It was developed basically in 1947

as a 12-blade axial-flow compressor in an annular chamber. The first unit had a shaft-hub, large pressure loss of 7.5% and a combustion efficiency of about 94%. Two blade holders reached the development of the engine in 1949, but initiated an investigation of the relation between high temperature strength and the gas rate of the blade material.

The chief value of the work with the 012 was that it provided a backing of experience for this research center.

#### Russian Specifications

The next engine demanded by the Russians was a 6,000 shp turbojet designed for a flight speed of 550 mph. at sea level. Powerplant diameter was to be 13.6 ft. and the gas reduction was to be 7 to 1.

Two years later the requirements were set with the Vys 012 turbojet engine with the following characteristics: 5,790 shp with about 1,233 shaft-horsepower thrust for an equivalent shaft horsepower of 6,234; rotational speed, 5,490 rpm; specific fuel consumption, 0.56 lb./shp-hr. Engine diameter, 41.1 in., engine length, 14.6 ft. The combustion chamber had an inlet velocity approximately 512 ft. per second.

Its combustion efficiency was 98.5% with a 2.5% pressure loss.

The success of this project stopped a painful program that a Russian team was developing, and also initiated an other set of detailed specifications. The



### Career opportunities for: Research, Development and Production Engineers

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**Honeywell**  
AERONAUTICAL DIVISION



Here is the first photograph of the guidance reference system for Project Vanguard.

Designed and built by Honeywell Aero, this sensitive electronic mechanism must keep the finless rockets on course despite intense vibrations and tortuous accelerations hitherto unknown. Because of these rigid demands, rugged, precise HIG-6 gyros were selected to sense pitch, roll and yaw in the system. The Vanguard Reference System is another example of Honeywell Aero's leadership in air-borne control systems.



**Mach 5 Wind Tunnel**

Chase Vought Aircraft's new Mach 5 wind tunnel, shown here in relation to a rocket is expected to be made for operation in January, 1958. Located near Mountain Creek, Texas, the 21,000,000 tunnel was compressed at about 10 to the first tests on the left to operate here, there follows through the supersonic test section on the right of the tunnel tunnel in the center building. The air is then exhausted through a glowing tower at the right which Chase Vought says, cost a quarter million dollars.





Aircraft wing section being fitted to new digital electronic control system for the Navy.

## The sky is not the limit for engineers

Advances progress of research and development are continuously going on at North America's Columbus Division—projects that stimulate the imagination. Missions, radars, antennas, flight control, fire control, servo-mechanisms and many more such projects are under intensive study. The men engaged are opening up entirely new areas in their professional fields.

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result will be achieved in 4 years of development, possibly 2 to 3. Increased research work.

Named the Sea Vixen, the fighter was equipped with power folding for its swept wing, variable nose-hat, modified tailboom for greater climb clearance, large radome nose, modified undercarriage and larger brakes.

First flight slated for summer. DH 110 will replace Sea Vixen in the Royal Navy's fleet of medium fighters. Performance details were not released but the replacement is expected only in a day.

Flight scheduling trials have been conducted with a prototype to increase in diameter and range.

## Missile Nose Spike Is Recovery Device

London-Bristol Aeroplane Co. has released details of a supersonic test vehicle used in development of the firm's rocket-powered missile and the Thor major engine.

Named the Bulbous, the test vehicle employs "supersonic" parachutes to slow it down from high speeds so it can be recovered for reuse. A long spiked nose sticks into the ground when the vehicle strikes the earth.

Tested even if there is possible to recover the Bulbous virtually undamaged after test flights.

The slender supersonic test vehicle appears to be about 36 ft. in length. Tests in design of the nose spike were made by dropping a dummy vehicle vertically from a crane so it would hit the ground at the correct velocity.

Parachutes for the Bulbous were developed by the Bristol Bros. and CO. company. Bulbous parachutes are released by a time switch while the vehicle is at supersonic speed. After initial deceleration, the small circles are released, drawing out a cone shape 30 ft. in diameter.

## New Tenant Sought For Hawker Plant

London-Bristol is in the defense program under it depends to provide the Hawker Aircraft Co. plant at Blackpool further work.

Majority of people was another tenant will be sought after Hawker's current program is terminated. Although the situation of other companies has been down to the hasty, new use for it has not been found.

The Blackpool plant is the biggest single aircraft production unit in Europe. Cancellation of orders for 180 Hawker found Hawker to begin laying off more than 1,000 workers employed there.

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Outboard location of twin Franklin engines simplifies servicing, replacement and loading and leaves ample cargo space for "flying crane" applications.

Bernard Sanders's Omega SB-12 is a tremendously promising approach to greater helicopter design simplicity and increased utility. Maintenance costs, long an obstacle to wider helicopter use, promise to be vastly smaller than in conventional designs. The SB-12, with its two 210-hp Franklin engines, has a tremendous safety edge over single engine helicopters. With a capacity of pilot and 4 passengers or pilot and 1000 lbs. of cargo, the SB-12 should find a wide field of utility.

We are immensely pleased that 75% of all the helicopters flying today, the Omega SB-12 is powered by Franklin.



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Large cargo space immediately below rotor hub at approximately 6 ft. well accommodates 1,000 lbs. of cargo when helicopter is used as "flying crane" without passengers.



Detail of engine installation shows easy accessibility and unusual V-belt drive which greatly simplifies gearing and maintenance vibration.



FRANKLIN's fused plastic seat cushion (above) was developed for use with aerial strap (below) stop.



## Shock Absorbing Seat Reduces Injuries

A shock absorbing seat to reduce the number of back injuries suffered in hard landings has been designed by Chance Vought engineers. Special springs are easily collapsed in jet fighters because the pilot sits far forward where the downward swing of the nose after the turn which have reached multiple impact loads.

Similar seats are being installed in a number of Navy aircraft. It was originally made for the F7U-3 Corsair.

The seat is suspended on a stainless steel stop which is secured to its upper end to the cockpit bulkhead behind the seat. In a dangerously hard landing a body landing on a snow-covered collapse, the stop struts several inches to absorb excess kinetic energy. There is little or no spring action and the permanently stretched strap must be replaced after serving its purpose.

The strap suspension was originally suggested by Christopher T. Knochman, chief of the Navy Air Crew Equipment Laboratory.

Vought has developed a flexible fused plastic seat cushion for use with the new suspension, which is contained to prevent the pilot's legs from sliding forward in the seat. The forward part of the cushion also supports the thighs in an upright position.

Two airplanes with instrumented seats and dummies installed were subjected to simulated hard landings. One was used to determine loads transmitted by standard seats and the other was used to test the new suspension and cushion. A significant reduction in loads was registered for the latter.



BIG BUSINESS

SMALL BUSINESS

## Which is the "helping hand"?

Ever consider that this thing we call Big Business is much less the economy of the U.S. itself? It's complex — it's dynamic — and it's constantly improving. Yet Big Business is not, and likely never will be, self-sufficient.

It is said that our smaller businesses are being crushed — squeezed out. Some inefficient ones will be. But not the ones who are making a real contribution. For example:

Formprag, providing the better grip of the spring-type clutch (in place of roller and interfit clutches), contributes added performance and efficiency to many products of manufacturers, both large and small. In so doing, it performs the function of the smaller specialist, those whom the major corporations are receiving important help.

This is U.S. industry's way. Big Business and smaller ones join hands in the interest of mutual betterment.

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A2-8C



QUANTICO HO4S-1 prepares to pick up fuel keg, used to transport fuel to scene of battle in vertical development operation.



MARINE SIKORSKY HO4S-1 at Quantico lands in rough terrain to unload prop, which is being driven through hangar door.

## Marines Put HR2S in Operational Status



MARINES AT QUANTICO load a 105 mm howitzer into HO4S-1 during Fleet Introduction Program flights.

By Claude Witte

Quantico, Va.—Accelerated Fleet Introduction Flight Program of the Sikorsky HO4S-1 two-engine helicopter has been completed at the Marine Corps Air Station here. A new squadron, HMM(M)-461, is ready to begin training exercises at its base here in New River, N. C.

The squadron commander, Lt. Col. G. B. Doyle, 31 of his pilots and 47 enlisted men have undergone six weeks of intensive familiarization and operational training with the new aircraft.

The major squadron mission is to provide vertical development transport for the Second Marine Division at Camp Lejeune, N. C.

HMM(M)-461 is the first Marine helicopter squadron to use the new HO4S-1, which, in turn, is the first two-engine helicopter to go into military service. It also is being purchased by the U. S. Army, and the ground forces have had a train here to observe the Marine training program.

In more than 200 hours of various missions, the Marines found no need for major modifications of the HO4S-1.

A number of small discrepancies that were uncovered will be corrected by the manufacturer or in the field.

The helicopters underwent some major changes before fleet tests were deferred. Damage to the rotor disc, for example, was assessed from 65 to 75 ft.

The Fleet Introduction Program (FIP), as set up by the Bureau of Aeronautics, calls for about 100 hours flight time on each of four aircraft. In the case of the HO4S-1, five weeks was not achieved but sufficient experience was gained to justify ordering the new

OVERHEAD WINCH is used to pull howitzer into HO4S-1 cabin (left). Loaded howitzer is tied down (right).







## Titanium Displaces Steel in J57 Engine

By Irving Stone

Los Angeles—How titanium has been applied to the J77 turbojet was revealed last at the 1974 Western Metals Congress by the W. H. Sharp, engineering metallurgist, Pratt and Whitney Aircraft Division of the United Aircraft Corp.

These benefits of the material were discussed:

- **Strength-to-weight ratio**, and excellent corrosion resistance, decided advantages for current as well as for future aircraft turbine engines.
- **Titanium** is a non-strategic metal and its use should be encouraged in every appropriate application.
- **Unobtainable** in many applications is competitive with steel.

The J77 engine was originally designed with a steel compressor. From the start, the main intention in some models of the engine has been to use weight. Also, problem of corrosion of the steel compressor is a real one, Sharp said. "There are no known high strength steels that are truly resistant and the best findings available on subject to corrosion and damage in practice in the air frame. This even coated steel parts must be corroded and their strength and performance impaired," he pointed out.

Titanium alloys have excellent oxidation resistance and this positive advantage will contribute to conservation of strategic materials such as chromium and nickel. This should be a very positive advantage from the standpoint of engine maintenance, Sharp said.

Numerous engines with titanium rotor parts of 1700, 3400, and 6100AM stations, alloy have been produced and considerable flight time accumulated, Sharp revealed. Finally, Pratt and Whitney has gone into production with the new J614-4V alloy. All of the company's experience and tests show that this alloy represents the best balance achieved in an AlphaBeta titanium alloy to date, he declared.

The J614-4V alloy is a good elevated temperature strength up to 500F and improved oxidation resistance in the last working temperature range, a factor which contributes to closer control of dimensions and ultimately to improved efficiency.

The 4% vanadium-beta beta forming element provides strength and added resistance against instability under stress at elevated temperatures.

Significant advantage of the J614-4V alloy is its reduced density. Sharp said. It is about 5% lighter than the Ti-550A and Ti-340A alloys and 2% lighter than G138AM. Thus, for a given volume requirement the J614-4V alloy is the basic factor. Sharp pointed out. Consequently, Pratt and Whitney is specifying the alloy for blades, discs and disc spacers.

### Best Alloy

Apart from commercially pure titanium, which is being specified where forming and welding are required for a perfect subject to only moderate stress levels, the most attractive alloy for the welded stationary applications is A110-AT. This alloy is specified for compressor case of the J57. High yield strength coupled with good weldability have determined its selection.

Although Pratt and Whitney has been producing engines with titanium rotor in this two case, it has not passed the application of titanium for these parts to the point to where it is the main factor for steel counterparts, Sharp said. "A fast phase" has been reached, he declared, and the company is now the point where it will have to resort to titanium and new techniques in forging and rolling practice. Consideration is even being given to reduction

of metal loss that occurs in cutting lad and hot wire cut blades.

Concerning on refinements in the forging of the fast stage compressor disc, it was pointed out that the net weight for the disc forging has been reduced from about 128 lb to 75 lb representing a reduction of 35 to 40%. Weight of the finished roughed disc is 30 lb, and utilization ratio (finished weight/rough weight) has gone from an original value of 0.15 to the present value of 0.30, Sharp declared. Figure he gave for the steel disc was: rough weight 126 lb, finished weight 41.2 lb, which gives a utilization ratio of 0.33.

In making the recent advances on forging titanium compressor discs are not competing with steel on a utilization basis," Sharp declared.

### Compressor Blade Use

Use of titanium alloy in steel flow compressor leading is a "trend," Sharp said. "This represents the advantage of the corrosion resistance and the low density of the material." Compressor blades made from titanium are at a lower laboratory status in service, demonstrated by increasing dynamic stress on steel and titanium compressor blades measured in adjacent area in a small flow compressor disc. Since the titanium blades develop a fatigue

### Explosive Forming Eliminates Steps

Los Angeles—Complex shapes in high strength materials which formerly would be forged, now can be made in one step process, according to Keith Whitlock, Lockheed design engineer. Whitlock outlined the method in a paper delivered to the Special Forming Techniques session at the 1974 Western Metals Congress here.

Cold-chamber (or high velocity) forming, the process described multiple operations involved in forging, replacing these with a single operation in which a specially shaped charge drives rollers of already finished material into dies of desired shape. Pressing the explosive shock shock waves through the rollers at very high velocities, creating a plasticity in the material. The main point is that the die is the die, the shock waves are passing through the material in the plastic state. By this time the material's natural tendency returns, the forming has taken place.

- Advantages of the system, Whitlock said, include:
  - Finished parts free of residual stress.
  - Consistent production of uniform parts at close tolerances.
  - Incomplete shapes made from hard material at much temperature without heat treatment.

Two examples of explosive forming, Whitlock listed were forging of a cup 4 in. deep, 3 in. diameter, from a 18 in. diameter billet of 5024, and a 2024 alloy rim section, 10 in. thick, 10 in. diameter which was expanded to 12 in. diameter rim.

Second set of explosives outlined by Whitlock was subject working. The example given was precise drilling of close tolerance holes in hard material. Normal drilling or punching resulted in close drill and punch tolerances, he said. Instead, a modified method was used, driven by explosive charge, which produced the desired holes and was capable of accuracy as before replacement.



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These benefits of the material were  
discussed:

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The 4% vanadium-beta beta forming element provides strength and added resistance against instability under stress at elevated temperatures.

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These weather items prepared in consultation with the United States Weather Bureau

# CLEAR AIR TURBULENCE

HOW IT AFFECTS HIGH-ALTITUDE FLIGHT



Heavy clear air turbulence was reported at 55,000 ft. about 70 miles NE of cloud line shown above. Notice how jet contrails flow out and disappear in wake of flyer jet.



Vertical gyro scales of 30,000 ft. to 55,000 ft. show clear air turbulence in layers 1 to 5 miles thick at level of high winds.

Factors in the 30,000 to 55,000 ft. levels often encounter clear air turbulence. It is not all coldwave activity down the drifts associated with vertical currents in various clouds. Though brief, this effect may be severe.

Clear air turbulence is caused by turbulent eddies in regions of low level wind shear, that is, wherever wind velocities (speed and direction) vary sharply over short distances. It is

generally associated with the temperature and eddy shear stress. Conditions in wake of jet flight. Hot and cold clouds in jet wake flight level. Rapid temperature changes. Fluctuations of upward velocity. All can indicate approaching turbulence. What is the clear turbulence in air caused. Reduce speed. That may reduce severity of jolting. Change altitude. Change direction. All turbulence crises, then assume heading.

Altitude Mirrors associated with air waves. Collimated altimeter a continuous altimeter shows these clearly in their air.

Through canopy. Moody conditions. Vertical Post. British in Moscow.

## New Mobil fuels meet requirements for high-altitude flight

Mobiljet fuels flow freely, give maximum performance. Various grades permit operation over a range of temperatures from -76°F to +160°F. Volatility characteristics allow easy starting on ground and in shade, prevent rapid evaporation, vapor lock when at altitude.

Altitude Mirrors associated with air waves. Collimated altimeter a continuous altimeter shows these clearly in their air.

Through canopy. Moody conditions. Vertical Post. British in Moscow.



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strength almost equal to that of Good. Aerobically used for blading, the even buildup of lower operating stresses and comparable fatigue strength adds up to a clear advantage for the titanium blade, Sharp said.

Utilization ratio for titanium over previous blading runs between 0.25 and 0.50 depending upon manufacturing practice. High utilization ratios have been obtained locally by personnel logging and by the rolling method, Sharp said.

Generally speaking, he added to titanium blading up to now have been made by the same methods as for steel blading.

## Stimulated Development

Application of titanium to blading, however, he said, "has stimulated much development work directed to improved utilization. The current price of titanium is a very real deterrent to full utilization of this metal, and we can expect to see continuing progress in this area."

Situation with respect to compressor disk spaces is similar to compressor discs and blading in that utilization ratio for titanium at 6,311 is the same as for steel. Compressor spaces are welded, built solid (expanded) or of reinforced cross section and the configuration of the finished space and its fit to the shaft does not make for a high utilization ratio. Pratt & Whitney's approach is to bring the casing as close to the finished part to reduce a higher ratio, Sharp pointed out.

In whiffles such as the low compressor case, which has been produced in both commercially pure grade titanium and A-110, utilization is relatively high because much of the weight is in short metal disc, Sharp reviewed. Rings which support the disc are reinforced from both butt welded rings. In casting the welded rings of extruded aluminum, as opposed to castings, he said, a centrifugal cast in aluminum has been achieved recently, he said. Although the commercially pure grade is being extruded into such shapes, extrusion of the A-110 alloy presents problems, and it probably will be some time before A-110 extrusion will be available for the welded structures, he said.

Inlet case also presents relatively high utilization because of predominance of sheet metal in the part. In that case complex welded, dual butt welded extruded shapes have been used as opposed to the expensive rectangular section.

Titanium-titanium compressor case, made of A-110 titanium alloy, is the most complex welded Pratt & Whitney has tackled, according to Sharp, and much development still is going into the utilization of metal in the various refined rings and forged components. It

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## KAISER ALUMINUM EXTRUSION ADDS



Kaiser Aluminum extrusions (shown in the shaded area in the above outline drawing) are lightweight, yet give maximum strength to lower wing spars of the North American B-160 Super Sabre.



This strong Kaiser Aluminum alloy extrusion will be part of the Super Sabre's wing spar when it is machined. One of Kaiser Aluminum's two light 8000-ton presses made this extra-large extrusion possible.



Finished after other machining is strong enough to stand in a critical fuselage joint, light enough to be lifted by one man, and it is machined to the tolerance of an expensive valve.

## SUPER STRENGTH TO SUPER SABRE

### AND CUTS WING SPAR COSTS

From the moment the Super Sabre's designers first decided on the weight and strength characteristics necessary for the front wing spar, the engineering, manufacturing and purchasing coordination at North American Aviation began clicking.

After an exhaustive cost analysis of the raw material, parts, labor and tooling, North American's engineering specialists recommended that the wing spar be made in three sections—two aluminum extrusions connected in the center by an aluminum forging.

#### Strength Without Stress

Because the extrusions must undergo special machining, and must remain flat and free of warpage after machining, it became evident that stress-relieved extrusions would make the job easier and less costly.

North American purchasing personnel, working closely with their manufacturing and engineering departments, chose Kaiser Aluminum extrusion for three very good reasons:

1. At Halescorpe, Maryland, Kaiser Aluminum has two 8000-ton heavy presses capable of making the extra-large extrusions required.
2. Kaiser Aluminum's equipment also includes a 750-ton stretcher which stretches and levels large extrusions, thus relieving stresses for the required machining.

3. Kaiser Aluminum's superior flexing method efficiently insures, air pockets and other weaknesses from the extrusion. Thus, Kaiser Aluminum alloy 7075-T6, used in these extrusions, is not only extra strong (ultimate strength, 81,000 PSI), but also extra high in quality.

The net result of North American's careful planning and Kaiser Aluminum's skilled manufacturing is the production of lightweight, high-strength 8,000 spars at an average cost per pound that predicted in the original cost analysis.

Kaiser Aluminum now offers 3 major facilities to meet your extrusion requirements... a light and a heavy press plant at Halescorpe, Maryland, and a new light press facility at Dallas, Texas.

For immediate information and assistance on extrusions, call the Kaiser Aluminum sales office listed in your phone directory. Kaiser Aluminum & Chemical Sales, Inc., General Sales Office, Palmolive Bldg., Chicago 11, Illinois. Executive Office, Kaiser Bldg., Oakland 12, California.

## Kaiser Aluminum

See "THE KAISER ALUMINUM STORY," Aluminum Today, MFC Network. Consult your local TV listing.

is expected that a high utilization ratio will be obtained by replacing the outer solid ring with flink butt welded contour flanges and the inner outer flange and inner solid ring with sheet metal, which will be hot formed.

Citing an outstanding example of approved utilization of titanium reported by a Boeing engineer on the development of the intermediate component case outer ring, these figures were given: Inlet weight of A-110 fan solid ring was 116 lb. By using the flange flanges (transporting the various contours of the finished part, which are then rolled into semi-circles and flink butt welded together, inlet weight has been reduced to 171 lb. In addition to this there will be a case saving in metal lost at machining cycle as the flange case contour ring.



**Electro Wing Box Completed**

First completed super structural component of Lockheed Electric turbo-prop transport-101 outer wing box removed from jig at the Lockheed plant at Burbank, Calif. It is ready for next step, drilling of holes for attachment of leading edge, being used by Texaco under subcontract. Assembly of the bridge has begun and making of the wings and tailings is scheduled for August. First flight is scheduled for January. Electro will have a continuous section fuselage, carrying its 115-hp. turbo turbo will back toward the tail. Fuselage is built up with longrange, square and straight line sections, which are then joined longitudinally to a master mating jig.

## New York Subsidiary Planned by Bristol

London-Bristol Aeroplane Company (U.S.A.) Inc. is to be formed in New York as a subsidiary of the Bristol Aeroplane Co. Ltd., England. It will conduct sales and allied activities.

The chairman of the new subsidiary will be Air Commodore F. R. Bails, a director of the parent company. Initially, the president and chief controller will be Mr. Stanley Haggitt who is vice president of the Bristol Aircraft (Wentworth) Ltd. in Canada and was formerly general manager of the company's West Coast branch. Later on the new Mr. Haggitt will be succeeded by Mr. David E. Prosser, who is being released from his present appointment in Bristol on its attack, Washington.



## FOUR OPENINGS FOR FLIGHT TEST INSTRUMENTATION ENGINEERS

**Electronic Development Instrumentation Engineers.** To conceive, design, laboratory-simulate and test aircraft components and assemblies aimed at automation of data acquisition and analysis. Requires Electronics or Physics degree and one to four years experience in electronics design.

**Instrumentation System Design Engineers.** To develop and coordinate overall instrumentation system designs and assessment techniques for collecting data for any engineering field. Requires Engineering degree and one to four years related instrumentation experience.

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## Soot Solved This Problem

One thing Richard (Rick) Macdonald could say for flight and instrumentation—it had variety. Here he was, in line of duty, hunting a coal oil lamp on the Mojave Desert.

Looking back, Rick saw that the whole Crusader instrumentation program had been a series of shifting scenes. He'd started by talking to different specialists, finding out the kinds of flight information they wanted. He learned a lot about tanks, loads, acceleration and fighter. Then came the things Rick's instrumentation would have to detect.

Designing and building the system took less in another direction. There was the airborne equipment—up to 32 miles of wiring and 600 pounds of black boxes for a single demonstration aircraft. Each sub-system was vacuum-tube-trimmed, breadboarded, checked out and packaged to fit key corners of the Crusader structure.

Taking shape at the same time was a mobile ground station—another project with which Rick was associated. It brought flight test instrumentation and data processing closer to information than they'd ever been before. At Vought's Mojave Desert test base, Rick's equipment clicked. It speeded preparation for

the Crusader's dramatic operational debut—the Thompson Trophy-winning speed run.

There was just one hitch—a National Aeronautics Association rule which would have absolute deviation to 121 feet during the Trophy dash. A bunch of standard barographs would ride with the pilot, its stylus striking out exact altitude on a stacked cylinder. But enough—but Vought's desert crew didn't have a workable way to blacken duplicate cylinders for projection. And precise warm-up flights were essential.

That's why Rick went hunting for a coal oil lamp. He found one in the store of a desert outfitter. Back on the base, the lamp was lit and the work turned up. It "sooted" the purpose perfectly.

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Mobile shavers used exclusively hand air unit with a 15,000 lb. thrust jet engine without afterburner.

Frequency (cps)	Reduction (db)
20	
100	30
100	
1000	40
100	
100	45
1000	
1000	45
1000	
1000	45*
1000	45*
1000	
1000	45*
1000	
1000	45*
1000	
1000	45*

\* Based on reduction of noise, all type shavers a about 25-30 db. greater at these higher frequencies.

also can be easily moved by a light tug or by several men.

The new model is of somewhat different design than those now in use, according to Lenczowski. The shell of the structure has been designed to withstand the high velocities and temperatures of current powerplants.

The shellway, as he calls it, is the center of the shaver will require changing every 180,000 hours under normal operating conditions. If used with an afterburner equipped engine, change frequency will increase.

Lenczowski is designing a special sound attenuator for shaver afterburner-equipped jets without the use of water coolant. He is also working on a shaver for commercial jet aircraft.



### Economy Crimps Douglas C-132

Douglas C-132 every-way-inclipping transport designed as long haul, heavy cargo but its exhaust together with U. S. strategy may cut post stage of full-scale wooden truck up down late because of economy rate in USAF budget. These are as funds for it will year. Mock up was built over two years ago. Project of C-132 would be 100,000 lb. Tanker version would be capable of three post price and design retooling.



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defending the B-52 intercontinental bomber is the Arma MD-9 fire control system that picks up, tracks, and with uncanny accuracy fires at its target.

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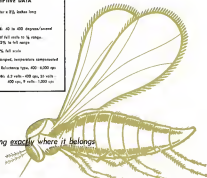
*A Division of American Bosch Arma Corporation*



# DESCRIPTIVE DATA

- SIZE: 1 inch diameter x 2 1/2 inches long
- WEIGHT: 2.1 ozs
- RANGE SCALE RANGE: 40 to 400 degrees/second
- UNCERTAINTY: 0.1% of full scale to 1% range, within 2% to full range
- RESOLUTION: 0.01% full scale
- DAMPING: Fluid damped, temperature compensated
- FREQUENCY: Variable Frequency type, 400-6,000 cps
- MOTOR EXCITATION: 4.7 volts - 400 cps, 31 volts - 600 cps, 9 volts - 1,200 cps

Putting the sting exactly where it belongs



## GOLDEN GNAT

### Miniature Rate Gyros for Missiles and Aircraft

Here is a precision, miniature rate gyro. It's tiny... measures only 1 inch in diameter and 2 1/2 inches in length. It's rugged... withstands 100G shock and 100 vibrations to 2,000 cps. It has a record of proven performance.

Even under the most severe environmental conditions the Golden Gnat will perform as required. To make this possible many unique design details have been incorporated. One such detail is the Gnat's gold plated steel housing for improved corrosion resistance and positive thermal sealing.

Whether the need exists for high performance miniature rate gyros such as for anti-gravity calibration in missiles and aircraft, antenna stabilization and fire control applications, the Golden Gnat is ideally suited. Write for Bulletin GN - Minneapolis-Honeywell, Defense Division, Dept. AN-1480 Soldiers Field Road, Boston 35, Mass.

MINNEAPOLIS  
**Honeywell** H  
BOSTON DIVISION



Over Nine Gyros  
Shown actual size



### New Prop Indicator Installed on KC-97's

A new propeller indicator indicator, designed to measure engine displacement resulting from propeller vibration, will be installed on 508 C- and KC-97's under development. The indicator company has installed a 903, 908 contact in Consolidated Electrodynamics Corp. for the device.

The device is used to give accurate vibration warning when engine vibration exceeds predetermined limits during flight. However, the system's capacitor-mounted vibration pickups are sensitive to turbulence and the shocks normally encountered during take off or landing.

The system includes a means of periodically recording engine vibration levels for subsequent engine performance studies.

Consolidated Electrodynamics also is developing similar systems for turbo-prop engines. The three basic capacitor-mounted vibration pickups will be installed on the engine's crankshaft, mainshaft and propeller.



### Hydraulic Pump

The 3,800 psi hydraulic pump, which has a delivery rate of 15 gpm, and operates at 1000-1500 rpm, is installed in General's experimental F-51 Harrier, one of each of the four engines. Pumps which can deliver 50 gpm when operating at full speed of 4,000 rpm, supply power to the plane's elevator, rudder, flaps, its nose and lower landing gear and its specific rotor engagement. The unit is now being developed for use in operation at 1000-1500 rpm.

control from -65 F to +150 F. The valve is high frequency and low displacement, it will have no reverse effect on prop vibration which is low frequency relatively large displacement.

Address: 100 North Street, Malden, Mass., 02148.

### Valves Developed for Jet Air Conditioning

A new line of electro-pneumatic valves for commercial and military jet aircraft air conditioning systems has been developed by Vapor Heating Corp.

The valves, which control the amount of hot or cold air to be mixed with cold air to produce desired cabin or cockpit temperatures, will be used on Douglas DC-8 jet transport and suspended military jets.

The valves are made from duct steel ranging from 1 to 1 1/2 in. in diameter. Advantage of the unit is that they are compact, smaller and lighter than electric motor-driven valves now on the market, and Vapor Heating, which claims that they also weigh less than most comparable pneumatic valves. The 7 in. duct size shown is 13 1/2 weight lb.

The valves are designed to operate at

## marion

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The welded type operates on 480 cycle 115 v. a.c. both assemblies are actuated by electrical signals from such temperature controls as resistance pickups or Vapor Floxing nuclear contact thermocouples.

The new valves meet the latest military specifications, according to the manufacturer. Address: Dept. PE, 17 90 E. Jackson Blvd., Chicago 4, Ill.

## **OFF THE LINE**

**KS-54 Kellgren Pressure Control System** will be used as standard equipment on the Fairchild F-27. Fairchild owns copies, but plans to release the KS-54 Kellgren system was made by Kellgren Division of Fairchild Engine & Airplane Corp., staff makes of valve transmission equipment. Features of the Kellgren pressure control system is its ability to monitor and control valve pressure with great precision.

Radson Tool & Engineering Co. is expanding its service unit parts sales and service facilities into a separate division. Features of the program is the production of kits which will allow sailors using Radson units to maintain older models to 1957 requirements on a do-it-yourself basis at minimal cost.

Canadian says that over 10,000 of its units are going on more than 60 major orders throughout the world.

A \$340,000 contract for new machine tools has been awarded to General Electric Sealing Corp. by USAF for use on its B-47 jet bombers. The new seal called Henshaw Seal, is made of a helix, resistant metal form containing gas under pressure. Good up to 1,000° the device will be used to replace oil sealed seals on B-47 engine engines, saving considerable maintenance time and cost, according to the company. Seals can be installed without use of heat and are available. Address: 99 E. Benthaven Ave., Valley Stream, N. Y.

Early maintenance in the Sealing control system is delivery operation of the newly installed Westinghouse photoelectric approach lighting system installed at Washington International Airport. Company has not found a test which will stand up under the repeated sequence testing demanded by the system. Sealing has under system installed at New York International Airport (JAN 21, 1958, p. 91), Newark Airport and March Air Force Base.

Royal Swedish Air Force is acquiring its new, improved jet fighters, the Saab



## **Test Facilities for Atlas**

Steel platforms at launching level (left) are mounted in building where former tests are made on fuel tanks at Conner's Atlas XRM. Tubular steel tracks for transporting the Atlas missile (right) made into test building (left background). Also standing on platform are Marshall Kesselman (left), chief engineer, and J. R. Drayton, manager, Conner's Atlas.

AIRPORT WEEK, April 2, 1957

# THE DART



## Rocket-propelled SURFACE MISSILE gives wings to ground combat

The fast and powerful Dart is a rocket-propelled surface-to-aircraft missile designed for Army Ordnance by the Aeroquip Development Corporation, a subsidiary of Curtiss-Wright.

While its design and performance are classified, the Dart has been described as a simple but effective anti-tank missile—a single hit from which would probably destroy a heavily armored tank. The five-foot long, highly maneuverable missile has a rocket-propelled rocket motor.

The Dart represents one of the Army's most advanced ground combat weapons. Another development in the Curtiss-Wright propulsion family, it is typical of Curtiss-Wright's leadership in power to preserve peace.



J15 engine, with Goodrich turbosuperchargers, which makes Producers' plan, with J15 engines as being extra fitted to the turbine for Goodrich General Electric Alford is supplying both model tests.

Less, but will manufacture and will reduce engine temperature control equipment under U S patent rights migrated to General Motors.

Two by British firm, Ultra Electric Ltd. The model, made used as British planes, with test flow to some level reduce speed and temperature under all operating conditions. Less also announced that it has been recently awarded a contract for approximately \$100,000 by Air Materiel Command for flight control system, engine and various special tools for the Boeing KC-135 jet tanker.



NORTH AMERICAN F100 refueled by KC-97 with boom equipped with drogue adapters.



STRUTS in drogue on tanker boom adapters provide required stability.

## Adapter Converts Boom to Drogue

Aerial refueling adapter for quickly converting the boom tanks for on-air refueling aircraft equipped with the probe-dropper system has been developed jointly by Sikorsky Test Mfg. Co., San Gabriel, Calif., and Wright Air Development Center.

The new adapter would make compatible the boom refueling system of the KC-97 and the forthcoming KC-135 jet tankers with such Air Force fighters as the F-100, F-101 and F-105, and Navy aircraft.

These receiver aircraft would need no conversion to use the adapter. The modification has been successfully

flight-tested in aerial refueling tests involving the F-100 and KC-97 under at Wright-Patterson AFB, but decision is placed the device in production has not yet been made.

About ten feet long overall with its connectors, boom and drogue, the adapter is quickly fitted to the boom after removal of manual boom and. During flight the boom and drogue test from the boom and connector is made with the receiver's probe in several stages.

Drogue is composed of strut, instead of a solid fixed strut, for better aerodynamic stability during hookup.

## PROVEN beyond QUESTION



## AMPHIBIOUS FLOATS

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Edo Amphibious Floats are approved by the Coast Guard, the Department of Defense and other with only a slight modification in design and construction—this has resulted in increased utility. Other applicants are pending.

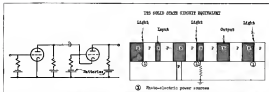


Why not investigate how the ability to land on soft or uneven water will increase the utility of your amphibious aircraft? Send for Edo Float brochures.



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## AVIONICS



**SOLID-STATE CIRCUIT**, including battery power supply (left), which performs function of two-stage vacuum tube amplifier (left), a two-stage approach to micro-miniaturization. Complete solid-state circuit could fit in next size of present transistor.

## Solid-State Research Brews Upheaval

By Philip J. Klein

New York—Realization is looming at the state of the electronic art, spurred by the intense demands of guided missiles, space vehicles and high-speed air craft. It looms the upheaval, known as "micro-miniaturization," and is made possible by basic new knowledge emerging out of research in semiconductor materials.

Micro-miniaturization could deliver the traditional lines of development that has separated various equipment state-of-the-art from complete systems.

A complete micro-miniaturized amplifier may consist of a multi-stage solid-state circuit in which various devices mutually perform a variety of component functions. The entire amplifier might be contained in a case no larger than two percent-size transistors. Most state-of-the-art of the present outlined during the recent Institute of Radio Engineers convention here in the last IRE, means over devoted efforts to the subject of micro-miniaturization.

With micro-miniaturization, the basic techniques and equipment are

ready in hand to permit the first look at the nation's other side through atomic instruments recorded in a space ship for radar, sonar, and other devices required to accommodate a sea view.

John R. Moore told the IRE. Moore is general manager of North American's Aerospace Division. In making the weight and cost of various equipment critical in a missile, micro-miniaturization "has been dramatic effects upon the nation's size, weight, hence its combat range, its energy, vulnerability and method of operation," Moore said. For a space ship capable of occupying the outer gravitational field, about 200 pounds of solid-state equipment weight is required for every pound of payload and avionics in the final stage, Moore said. (The ratio is 1:200 for the Lockheed X-15, which is a vehicle for studying re-entry vehicles and for studying re-entry problems.)

**Solid-State Circuit**  
Despite significant progress in the past decade in shrinking volume, weight, and component size and weight, IRE, speakers suggested new techniques and concepts which may permit for greater gains in the next 10 years.

For example, although a transistor is far smaller than its vacuum tube counterpart, the tiny semiconductor crystal which is the heart of the device occupies only a small fraction of the total volume of a transistor. The rest is supporting frame, connecting leads and other parts. Dr. Claude Benoit said that Benoit is managing director of engineering research and development for General Mills' Mechanical Division. Benoit's paper was the work of four authors, including Dr. Claude



**NEW TECHNIQUES** and materials have speeded pace to major reduction in size of conventional components such as capacitors, resistors.

Shuster, John W. Bellingham and L. K. Lee, all of General Mills.

When a number of such space-saving transistors are used in an amplifier it is necessary to use transistors, capacitors and resistors that will not contribute to the electrical performance of the circuit and introduce a source of unreliability, Benoit pointed out.

### Size Reduction

Significant size and weight reduction could be achieved, Benoit suggested by developing techniques for making a complete semiconductor circuit by growing or fabricating a complex series of semiconductor crystals capable of performing the functions of transistors, capacitors, resistors, capacitors and power supply.

For example, Benoit described a possible solid-state circuit, consisting of a series of P-N junctions, which might perform the functions of a semiconductor capacitor, resistor, capacitor and power supply. (See sketches, p. 56). Three of the junctions which

dissipated by light could provide the power required for circuit operation. These active junctions, based on the direction of high resistance, function as resistors. Only one "control" resistor is required.

Dr. Shuster, who has applied for a patent on such solid-state circuit, told Avionics Week that he was aware of the problem of capacitor matching, but can deliver elements of such a circuit. However, he believes that can be overcome by semiconductor surface treatment.

"Carrying over's imagination a step further, we can visualize replacement of germanium silicon, arsenic, boron, indium and other types of organic and inorganic materials deposited surface in volumes of a thousandth the space now occupied," Benoit said. Benoit recognizes that considerable research remains to be done before such solid-state circuit becomes an operational reality. For example, techniques must be found to eliminate or compensate for variations in semiconductor properties with frequency and

temperature, and for material aging, he said.

Support for the feasibility of Dr. Benoit's concept of solid-state circuit came from another IRE speaker, Henry A. Stone, Jr., of Bell Telephone Laboratories.

### Energy Storage

It is well known that there is a capacity storage in semiconductor junctions, and perhaps less well known that in a reverse-biased junction, the energy storage is equivalent to high capacitance per unit area with a very high "Q," Stone said. He admitted that there were problems yet to be solved before semiconductor junction capacitors could compete on a general basis with their conventional counterparts, but added that the type device already is being considered for use in certain applications.

The possibility of growing complete solid-state circuits was suggested several years ago by General Electric's Dr. Walter A. G. Baker, and Air Force Cambridge Research Center has been

### What Is Micro-Miniaturization?

Micro-miniaturization is meant that a new class of electronic equipment and weight by several orders of magnitude over present sub-miniaturization. It is a potential technological breakthrough in the electronic art which is coming at the state of electronic new types of components and techniques arising from research in solid-state phenomena.

The transition, which marked a major upheaval in the electronic art in less than 10 years, is but the first of a host of solid-state changes and new miniaturization which will open new horizons for the electronic circuit designer and permit miniaturization in new advances. The new Moore, or Vannevar, a super-miniaturized semiconductor capacitor which permits to increase sensitivity of radio and other communications by a factor of 1,000 (IRE Feb. 28, p. 47) is a case in point.

The classical criterion of an improved component, the technique of its use, and the discovery of a new solid effect in these materials can now do more to revolutionize the performance of an electronic circuit than can all the other progress of the circuit designer," according to E. W. Harold of Radio Corporation of America's Princeton Research Laboratories. "The broad-based research of circuit and device, which started with vacuum tubes, is now being in more and more applications at all frequencies," according to Benoit.

The growing importance of solid-state phenomena and devices to circuit designers, and the need for keeping the latter abreast of rapidly new developments in this field is evidenced by a symposium on The Role of Solid State Phenomena in Electronic Circuits, to be held in New York City April 21-23. The symposium is sponsored by the Polytechnic Institute of Brooklyn, Institute of Radio Engineers, Air Force Office of Scientific Research, Office of Naval Research and the Signal Corps Engineering Laboratories.



**TINY NEW COMPONENTS**, such as ferrite cores and diodes, point up future profiles of handling micro-miniaturized devices.



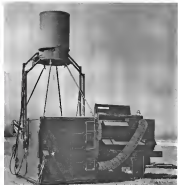






## Portable Tacan

Mobile Tacan ground navigation station (NMTN-8) is transportable by aircraft or truck. At descent location antenna is shifted into jacks (above) and lowered to ground. Antenna is then secured and radio assembly, superheated power supply, air conditioner and test equipment stored alongside (below). Tacan mobile package is manufactured by Cals Systems, Inc.



high degree of purity which should increase the quality and reliability of all components.

Fundamental research into new techniques for producing pure, dense materials for semiconductor bodies, the key to technological breakthroughs in the field of "hybrid" new electronic components and devices, GE's Dr. Hilda Kucy, observed. Such research, she said, requires the combined talents and efforts of several scientific disciplines, including physics, metallurgy and chemistry.

## 1975 FILTER CENTER 1975

(The following items are based on papers delivered at the annual Institute of Radio Engineers convention in New York—Ed.)

### ► Digital Computer Optimizes Circuits

Use of high-speed digital computer to perform routine electronic circuit design work led to dramatic personnel reductions in individual components was described by J. Adams, P. Pappas and D. Wilson of Remington Rand Univac, St. Paul, Minn. Authors reported that computer has been used to simulate "thousands of different circuits showing what types of outputs each will have and what tolerances are permissible for components." The present designer is select circuit that can operate with widest variation of component tolerances.

### ► New Logical Circuits Use No Diodes

Special type of magnetic core logical circuit which eliminates need for diodes by using switching threshold property of square loop ferrite cores was described by L. A. Russell, International Business Machines Research Center, Poughkeepsie, N. Y. Experimental models have been built using cores only 0.05 in. dia. x 0.075 in. high in circuits performing following functions: delay, majority, "and," "exclusive-or," "one-shot," "d and not d," "not d if true," latching and controlled branch ing, Russell said.

### ► Super-Speed Electronic Camera-Cams

Now using an electronic image converter tube, which can make photographs with exposure times ranging from 0.02 to 10 microseconds (millionths of a second), each up to five square inch exposures on a single plate of film, was described by R. G. Manger and R. W. Reinhold of PerkinElmer Technology, Inc., Lincoln, Calif.

### ► Nuclear Power Supply For Airframes

Availability of radioisotopes in kilowatt quantities and improvements in thermoelectric materials has opened the

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## How to Meet Tougher Specifications for Shock and Vibration Protection in Jets and Missiles

You're got to design to tougher specifications for increased shock and vibration isolation if you're going to protect the reliability of electronic controls in today's high-performance jets and missiles. Power accelerations, air-to-length loading, and extreme maneuverability combine to impose shock and vibration loads far beyond current MIL specs. These severe operating conditions must be reduced to a permissible environment suitable for electronic equipment.

### Isolator Requirements

Higher shock inputs require more stiffness in the isolator. In some cases energy for a given deflection, so there will be less energy to dissipate if the isolator bottoms. Higher vibration amplitudes call for greater resonances and increased transmissibility at resonance. And vibration protection under highly maneuvered acceleration demands a new balance of these characteristics.



### Use of Performance Curves

The characteristics of an isolator having the stiffest necessary for handling the shock and sustained overloads of jet and missile take-offs is shown by the curves of Figure 1. Basic curves can be used in choosing the proper isolator for operation under the expected service load loads, since they show both the deflection of isolator under a wide range of loadings and the maximum allowable deflection due to the combination of static load, sustained acceleration, and vibration amplitude.

A transmissibility at resonance will below three — considered completely low — is shown by the curves of Figure 2. The measurements for these

curves were made with a 20-point load supported on four 10-point isolators, with double-amplitude vibration input of 40 mils. These curves, showing performance for both base and back-and-forth movement, also indicate that the isolator satisfies the need for constant operation in every attitude of flight, banking, and maneuvering.



Figure 3 illustrates the importance of the R&A isolator that provides the performance characteristics shown by the curves, yet a dramatically adjustable MIL-size means of comparable load ratings.



Figure 3

### Additional Design Data

Other curves of isolator characteristics, and data on their use in designing for profitable environment on jets and missiles are contained in Barry Bulletin 575. This bulletin fully describes the complete line of ALL-ANGEL Barry-type isolators in standard MIL sizes. Write today for your free copy.

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was to build lengths, state power pack, and for sustained maintenance facilities, James L. Briggs of the Basic Air Development Center reported. Its potential would under construction will use a 10-watt thermal source utilizing a fluorescent tube. It is expected to have a thermal efficiency of 100 percent.

### Thermistor For Longer Tube Life

Use of thermistors to sense wall temperature tube heater systems, to provide gradual application of heater voltage and thereby decrease thermal stresses, has been suggested in a paper by J. J. Case and C. J. Brady for Massachusetts Institute of Technology's Gas Turbine Laboratory. Airbus and that thermistor can reduce maximum metal heater can react surge to 110% of steady state value, whereas conventional used some control leads to only 300%.

### Penetrating Measurement Detector

New type of magnetic detector, which utilizes use of magnetostrictive strain of a ferrite in a magnetic field, was described in a paper by D. Jaffe, J. C. Chalmers and N. Krasovskiy of the Army's Research Office—Durham, Durham, N.C. A barium titanate rod bonded to the ferrite converts magnetostrictive motion into an electrical output signal proportional to the square of the magnetic power.

### New Chassis-Display Tube—A 14

inch cathode ray tube, similar to the Corvus Stratoscope-Chorus Chorus which was electronic deflection and two separate electron guns—one for PPI display and the other for channel selection—was described in a paper by N. Schlegel, B. Muggins and A. F. Hogg of the TV Research Dept., Motorola Chicago. New tube reportedly provides high electronic display.

### Light Amplifier Gains Repeatable—Improved photomultiplier automatic and

improvements have permitted a 33-fold improvement in the stability of near-type light amplifiers. Amplification as high as 1,000 is now possible with maximum light input. B. Kimes of Radio Corporation of America's research laboratories told the ASEE.

### Proprietary Independent Automatic—New automatic combination which pro-

vide constant contrast between 100 or less of 100 or greater is described in papers by V. B. Rostov, R. H. Dahlback and D. E. Hoff of the University of Illinois, Urbana, Ill. One of them is a function of the "dark" "bright" areas which re-strict the resolution of elements to a



## To engineers interested in entering the field of INERTIAL GUIDANCE

Here is a field whose potential is equalled by the magnitude of its problems. The development of components with extraordinary precision should offer unmatched scope for achievement.

At Lockheed's Research Center in Palo Alto, engineers and scientists are working on a number of different inertial guidance systems. They are involved in all phases of inertial guidance and navigation.

Their expanding activities have created new positions for those possessing backgrounds in:

- Mathematics
- Physics
- Electronics (such as magnetic amplifiers)
- Servomechanisms
- Flight Controls
- Precision mechanical and instrumentation development
- Special purpose computer design

Engineers and scientists possessing experience or keen interest in advanced applications of inertial guidance are invited to write

E. V. Sklar (left), head of the Inertial Guidance Department, discusses navigation systems mechanism with Inertial Guidance Scientist A. L. McKenna (center) and Senior Electronics Scientist D. G. Peterson.

*Lockheed*

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"From Drawing Board... to Production Line"

# ATLAS

Precision Products

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• **Anson Corp.**, Los Angeles, maker of electronic subminiaturization, has added 15,000 sq ft to its previous facilities. Company reports orders for first four months were up 500% over last year and expects total year's business to top \$2.5 million.

• **Truss Instruments, Inc.**, has formed new British subsidiary, Truss Instruments Ltd. to manufacture and sell semiconductor products in the United Kingdom. New 12,000 sq ft. plant is now under construction at Redhill, 50 miles south of London.

### More Business Flying, Curtis Predicts to IRE

New York-Poly, percent more business-private aircraft will be operating in 1975 than today in contrast to a decrease in the number of military aircraft and essentially unchanged number of its carrier aircraft, roughly 1,500.

This prediction was made by the President's special assistant for aviation facilities planning, Edward P. Curtis, based on studies performed for his group. Curtis spoke here at the annual luncheon of the Institute of Radio Engineers Professional Group on Aeronautical and Navigational Electronics (PGANE) and Professional Group on Military Electronics (PGME).

General aviation, currently operating 60,000 aircraft, will be up to 90,000 by 1975, Curtis said, making this group the largest user of airports. The air carrier was expected to handle anticipated increases in passengers without increased use funds because of the use of larger, larger aircraft, Curtis said.

In 1975, Curtis predicted that 30% of the air carrier fleet would consist of turbo-prop or turbojet aircraft types, and that 18.15% of the general aviation fleet, representing executive type aircraft would be turbo-prop.

Curtis also said that current studies show that the Los Angeles area has by far the highest volume of hourly aircraft movements—over 500 during peak hours compared with 145 for New York and 100 in Chicago. Although New York has a much higher level of scheduled airline activity, the Los Angeles area's much higher general aviation activity gives it the edge.

Curtis said that his aviation engineering team has prepared a plan which, if properly implemented, should be "capable of providing adequate facilities for the future without undue constraints or an undesirable burden of cost to either airport user or the taxpayer."

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The reason is RCA's Ear Protector, a new and scientific approach to the problem of excessively loud noise. This device dampens out unwanted and penetrating sounds, permitting you to work comfortably in areas where

is the noise levels might otherwise be prohibitive.

Made of plastic, the Ear Protector surrounds the ear without actually touching it. Contact with the head is by means of a soft, replaceable, liquid-filled cushion that provides a comfortable, self-adjusting seal. It may also be adapted for intercom use, and for any other application where noise often interferes with efficiency.



Light in weight, highly efficient, sanitary, simple and inexpensive, RCA's Ear Protector belongs wherever noise becomes a nuisance or a nuisance.



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## BUSINESS FLYING

### Executive President Sales Tour Planned

By Ewen J. Doherty

New nations use executive transport will shortly be exhibited to prospects by its British manufacturer, which expects to send a demonstration on tour within the next few weeks.

Anglo-Am is the Hunting Percival Executive President, a smaller version of the firm's four-engine medium range transport/photoreconnaissance/ambulance, in service with the Royal Air Force and several NATO air forces. Hunting Percival recently signed a contract with the West German Aeronautics Force for approximately 50 million worth of transports.

#### U. S. Tour Possible

Initial tests of the Executive President demonstration will be through Europe and then the Middle East. The company is considering sending the airplane to the Western Hemisphere and hopes to show it in the U. S. It estimates that it can deliver the Executive President in a bare hull, to be finished here with interior and exterior, for \$119,000 plus 15% duty.

Initial deliveries of the Executive President are scheduled to begin this autumn. Hunting Percival has sold Avonmore Works, the firm's plant in Luton, Airport, Bedfordshire, England.

Basically, a high-wing all-metal airplane with flexible landing gear, the Executive President is powered by two three Lozorelli 201 series nine-cylinder engines developing 1300-1400 hp at sea level on 4400, 490-450 maximum continuous hp at 6000 ft. and 725 hp each at maximum lean condition at 11,200 ft. Full feathering three blade main rotorcraft blades permit operation in standard configuration, or as a biplane. The four-blade main rotorcraft blades are optional. Engines are supercharged and use a direct injection fuel system.

Normal seating for the Executive President is six passengers and a crew of one or two. It is lightweight, cruise will suit up to 12 passengers. With the former arrangement and a luggage allowance of 40 lb per passenger, the plane has a useful range of 1800 statute miles at 180 mph with normal fuel usage of 755 gal. External under wing "dipper" tanks of 50 gal each may be added to extend total range to 1,140 mi.

Using Secrets of British Aircraft Construction technique the Executive President's operating costs per ac-



BUSINESSMAN will be target in sales campaign by Hunting Percival for Executive President.

#### Hunting Percival Executive President

##### SPECIFICATIONS

Span	54 ft. 6 in.
Length	46 ft.
Height	36 ft.
Crew/Pass. Area	480 sq. ft.
Wind Capacity (Normal)	20.5 gals
Oil Capacity	6.6 gal
Electrical System	24 v.
Standard Empty Weight	5,500 lb.
Dependable Load	1,525 lb.
Normal Gross Weight	12,750 lb.
Maximum Gross Weight (With Auxiliary Tanks)	15,500 lb.

##### PERFORMANCE

Takeoff (Hot Season) Gross Weight	12,200 lb.
Cruise Engine Failure at Safety Speed (50 kts.)	5,000 ft.
Maximum Rate of Climb at Max. Continuous Power	700 fpm.
Service Ceiling	24,000 ft.
Maximum Speed at 1,550 ft.	224.6 mph
Cruise Speed at Max. Continuous Power at 6,000 ft.	221.5 mph
Max. Endurance Cruise Speed	105.5 mph
Rate Speed (Power Off) Gear and Flaps Down	79.5 mph
Landing Distance Over 50 ft.	1,325 ft.
Single-engine Rate of Climb, Takeoff Power, Gear Up, Flaps at Takeoff	220 fpm.

craft hour range from \$750 of the plane to \$1,750 for auxiliary to 5% of expected 750 hr.

#### Construction Details

The Executive President was constructed by the firm's factory. The fuselage is built in two sections, a nose portion including the cockpit and the rear fuselage with passenger cabin, baggage compartment, fuel tank and buffet. Cabin interior approximately 10 ft. long by 4 ft. 6 in. wide and 6 ft. 2 in. high with 8 ft. length. Passenger deck measures 5 ft. 2 in. by 4 ft. 2 in.

In addition to the rear cabin baggage compartment, there is a hold-along space in the nose measuring 52 in. H. for additional gear, including extra maintenance.

Wings are built in two sections, bolted to the fuselage at three points and are fitted with slatted flaps having three positions: retracted, 14 deg. down for takeoff and 30 deg. down for landing. Each wing has a flexible fuel cell of 62.5 gal. capacity, volume of the engines and 79.5 gal. oil volume. Fuel is normally fed from a collector tank, supplied by each pair of wing tanks.





### New Czech Helicopter, Lightplane

Shown at a recent Cessna display were a new experimental two-place light helicopter (top photo), the HC-2, designed and built at the Avionics Research Center, and Piper 30 75 hp, single-engine aircraft to provide a top speed of 50 mph and a ceiling of 11,000 ft. "Unique landing gear is unique in the history of the new helicopter lightplane," says a representative of the HC-2. "Top speed is 141 mph, cruising speed is 127 mph, and rate of climb is 570 ft/min. Gross weight is 1,870 lbs, wing span is 32 ft, 10 in., and length is 25 ft, 7 in. The helicopter is scheduled to go into production this year and will be available for export."



man-of-the-year. Mitchell leads Region Four with 99 distributors, north of 100 who achieved "Handed Gird" status.

Individual product sales include west to "Flying Aircraft, Inc., Wichita, Kan., for ADPs, Wiggins Aviation, East Africa, 18, autoplexes and Air-Cass, VIP equipment."

Top-selling GenCal areas are members of ADP-12, VHSI area and autoplexes, in that order, followed by the order in ADP-12, autoplexes and VHSI area.

Last reports that approximately 35,000 ADP-12, 15,000 VHSI units and autoplexes are currently installed in business and private aircraft.

### Cossan 1956 Exporter Hit All-Time High

An all-time high record of business and utility aircraft exports was scored last year by Cossan Aircraft Co. In October 1956, 312 planes were exported valued at \$4,160,000 compared to 226 units worth \$2,875,000 the year before.

Highest export sales were registered in Central and South America, which took 216 aircraft last year, according to M. P. Mellinger, Cossan export manager.

These included 17 Model 170s, 36 Model 175s, 40 Model 180s, 68

Model 182s, 34 Model 190 twins and one Model 125 agricultural version of the 1-19. Mexican purchases received 75 airplanes, 35 went to Argentina and 25 to Chile. Argentina ordered 25 planes from Cossan last year, so it has yet to receive most of its 1956 order. The company currently has 35 dealers and distributors in Central and South America. "There are being urged to expand their facilities, because," says Mellinger, "sales of business aircraft in this area have not reached even a fraction of the vast potential in view of the growth of the economies of our neighbor states at the border," according to Mellinger.

### Beech Lease Plans Build Big Sales

Wichita, Kan.—Finance and lease plans are adding to Beech Aircraft Corp.'s annual business plane volume. More than 550 million in plans have been registered by the company since inception of the program in the last two years.

Its finance rates are lower than normal on financing plans, the company points out.

Beech now has lost total lease and finance plans available. The first was registered only in December 1955 and three more were added last year. All are package plans with monthly payments including all costs and insurance.

A rapid growth in financing plans to serve business plane users, particularly small companies who can take to the air without making a heavy capital investment, is financed by Beech officials.

The company also has a lease plan for its distributors and dealers to enable them to finance demonstration. Sixty per cent of its domestic distribution have taken advantage of the plan, their purchases totaling nearly \$1.5 million.

### Major Aerial Survey Of Baffinland to Start

A major aerial photo survey of over 40,000 sq. miles of Baffinland, pending approval from navigation and maintenance problems, will start early in May.

Project, to obtain latest photo coverage for detailed mapping of the area, will be headed by Photographic Survey Corp., Toronto, under contract from the Canadian government.

To ensure accurate positioning of the photo assault, a network of 3500 ground stations is being established by a radio line, Field Airport Co., Ltd. Aviation work on the project started last summer, when over 160,000 sq. ft. of maps were shipped from Montreal to the area base of the expedition at Foul

Inlet, north of Hudson Bay and about 2,800 mi. north of Toronto.

PSC's fleet for the survey includes a Boeing B-17, supplied by the Canadian Ferry Airplane, a DC-4 and a DC-3. The DC-4 will make personnel and material to Foul Inlet and the DC-3 will relay there to eight Stinsons later. The total of the cargo will have a 10-week load supply. About 40 aircraft, ground station operators, technicians and operations personnel will staff the camp.

Aerial survey flights will be made at altitudes up to 24,000 ft. Average day time temperatures at ground level at the area is a little above freezing, much of the locale being north of the equator pole.

PSC and another associate, Aero-Magnetic Survey, Ltd., are currently carrying out more than a half-dozen separate survey missions in Vancouver covering 15,000 sq. mi. Since the company are working with the government and exploration firms to develop the country's oil and hydroelectric power potential, Lockheed Hudson, Lockheed 12 and Cessna 440 are being utilized.

**Lightplanes Given To Argentine Clubs**

Buenos Aires—Argentine Air Ministry gave 367 lightplanes of various types to standardized amateur associations and clubs.

The aircraft will become the legal property of the new owners after two years, in the meantime they will not be rented or sold to third parties.

Among the types distributed were Piper PA-31, PA-32 and P-5 Cubes, El Financiera, Fieseler, Fairchild, Waco and Taylorcraft aircraft.



### New Omni Converter

New Omni Converter can be used with Navy's Supplied 1444 as frequency communication units to provide reception. It is the aircraft's first VOR unit, it provides a duplicate unit or low cost. It is a 500-watt unit, only 12 in. by 12 in. by 12 in. and weighs 12 lb., the conversion 1.5 lb.

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## RESEARCH AND DEVELOPMENT EDITION JUNE 3rd

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### Need for Specialized Research and Development Information

Manufacturers are busy broadening their research and development activities. They recognize that their competitive position depends on the ability to compete in the urgent quest for new basic scientific knowledge in such diverse fields as propellants, aerothermodynamics, metallurgy, human factors and aerothermochemistry, etc. Because of the highly specialized sciences and technical fields concerned, manufacturers must often obtain research and development samplings from outside sources — government, university, scientific foundation, foreign and other manufacturers. In a sense, research and development has become a unique economy that is produced, bought and sold.

Expansion of research and development procurement activities has brought the need for a Guide which will increase the understanding of procurement procedures and available facilities and capabilities. To satisfy this need, the Research and Development Edition, an outgrowth of editorial pioneering in this field as outlined later in this announcement, will provide the following specialized research and development information:

#### INDUSTRY

Industry's vital and rapidly increasing role in research and development will be surveyed.

Indexed guidebook section tells industry what

facilities and capabilities are available, where they are and how to utilize them. Information on the marketing of research and development availabilities will be reported.

Newly revised government research and development contracting policies and procedures explained in detail.

#### GOVERNMENT

Missions, organizations and operating procedures of National Advisory Committee for Aeronautics; Air Research and Development Command; and Office of Naval Research summarized. Their laboratories, research stations and test center facilities, capabilities and availabilities analyzed in detail.

#### UNIVERSITIES AND SCIENTIFIC FOUNDATIONS

Extensive report on the important research and development programs at work at various universities and independent establishments throughout the country. Particular attention is given to the procedures of sub-contracting these resources.

#### INTERNATIONAL

Exclusive coverage of overseas sources of research and development available to industry as reported by our Geneva, Switzerland office.

### Pioneer Research and Development Coverage

AVIATION WEEK pioneered research and development coverage in 1953 when it presented an exclusive full-scale report on the USAF Air Research and Development Command and the gigantic industry, military and scientific production team that it coordinates. Thousands of extra copies were purchased by government, industry, university and foreign establishments and used as the standard reference for training research and development and procurement personnel.

In 1956, AVIATION WEEK was called upon to publish a second Air Research and Development Command Edition to report the many changes, improvements and advances that had been made. It is now in use as a current standard reference and training aid on research and development.

AVIATION WEEK's 26 full-time graduate engineers and aviation specialists located in key aviation centers throughout the world will provide the editorial manpower and know-how for this newest research and development service edition. Their extensive experience in this field which was pio-

neered editorially by AVIATION WEEK assures an information packed Guide of outstanding usefulness and serviceability.

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the rollers released. Since the pallet is designed with a slight incline, the cargo travels by gravity, piece by piece, to the inside of the plane.



This illustration shows a Traveloader picking up a loaded pallet. In transit, the load is carried securely on the board deck of the Traveloader.

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## Corporation Pilots Plan Standard Minimum Training Requirements

New York—Development of standard minimum training requirements for business plane operators is planned by a group of corporation pilots working with Flight Safety Foundation here.

Need for such a manual is threefold, corrective pilots feel.

• It will be of great value to small operators which have not established definite pilot proficiency training procedures, in addition it should be very useful to corporations just beginning to fly their own business planes.

• It will guide pilots, who realize the need for such regular checks with a desire to convert existing aircraft management personnel that money and time should be spent in training to maintain safety.

• Such concerted action by business pilots they feel, will indicate to Civil Aeronautics Administration that corporations aircraft operators are taking action to establish safety standards for their industry.

A prime objective is to establish an aircraft-board training guide for all business plane pilots, regardless of the type of aircraft they are flying. Currently, Keesler Corporation, who brash PSP corporate aircraft activities, is collecting pilot proficiency check notices from thousands of its own business plane operators in its own.

Next step will be to list through these and develop a common manual incorporating the best procedures.

Among the subjects to be covered will be frequency of pilot checks, methods used and the utilization of simulator methods used in outside agencies to check pilots will also be analyzed.

One of the difficulties facing some new corporation pilots in setting up such procedures for their operators is that if they must check other firm's methods they are likely to get as many different procedures as the number of people they ask.

A survey of several large corporate plane operators points this up.

• Company A: Two hours: 1800 to 2000 hours: 2000 to 2200 hours: 2200 to 2400 hours: 2400 to 2600 hours: 2600 to 2800 hours: 2800 to 3000 hours: 3000 to 3200 hours: 3200 to 3400 hours: 3400 to 3600 hours: 3600 to 3800 hours: 3800 to 4000 hours: 4000 to 4200 hours: 4200 to 4400 hours: 4400 to 4600 hours: 4600 to 4800 hours: 4800 to 5000 hours: 5000 to 5200 hours: 5200 to 5400 hours: 5400 to 5600 hours: 5600 to 5800 hours: 5800 to 6000 hours: 6000 to 6200 hours: 6200 to 6400 hours: 6400 to 6600 hours: 6600 to 6800 hours: 6800 to 7000 hours: 7000 to 7200 hours: 7200 to 7400 hours: 7400 to 7600 hours: 7600 to 7800 hours: 7800 to 8000 hours: 8000 to 8200 hours: 8200 to 8400 hours: 8400 to 8600 hours: 8600 to 8800 hours: 8800 to 9000 hours: 9000 to 9200 hours: 9200 to 9400 hours: 9400 to 9600 hours: 9600 to 9800 hours: 9800 to 10000 hours: 10000 to 10200 hours: 10200 to 10400 hours: 10400 to 10600 hours: 10600 to 10800 hours: 10800 to 11000 hours: 11000 to 11200 hours: 11200 to 11400 hours: 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**PACKARD ELECTRIC** / Don't save pennies here



**AIRCRAFT CABLE** / only to lose dollars here!

Hidden flaws in insufficiently tested lengths of aircraft cable are open invitations for performance trouble. You can't avoid them by watching price tags. But you can sidestep the entire problem through Packard Electric. Packard Electric's reputation for selling trouble-free cable has been firmly established with all leading aircraft manufacturers, who have learned that uniform quality is their best insurance against costly cable failures.

At Packard Electric, for instance, every tenth worker is a qualified

cable inspector. And, on many jobs, their work is augmented by special machines automatically testing every single inch of cable as it is being built. Because it builds uniformly high quality, Packard Electric has become the world's most reliable source for Low Tension, High Tension and High Heat cable, built to greatly exceed every established standard of performance and safety.

At Packard Electric, cable prices are the only things that are competitive. Nobody exceeds our overall quality

and dependability. And, in the long run, that's where you save! Make Packard Electric your Number One source of supply. Branch offices, for your convenience, are located in Detroit, Chicago and Oakland.

**Packard Electric**

Warren, Ohio

"Live Wire" division of General Motors

written report is made, new reports are issued to 600 ft and accurate measurements for the first 100 ft.

•Company D: Pilots checked every three months, with outside check made every six months, route check made every six months, land check every three months.

The company does not have an extra dedicated training, company pilots are free to use available aircraft for test, log or practice.

## PRIVATE LINES

Flux all-locks, going up to two hours advance notice, all substantially unexcused weather, are being tested at recent by Flight Advisory Weather Service Center. Included will be data on turbulence, thunderstorms, hail, dust storms, icing and turbulence, also in remote areas of low ceiling, restricted visibility and strong gusty surface winds. ATCS located within the area affected by the flux advance or within 200 mi of affected area will broadcast the advisory on receipt and make those in

subsequent scheduled weather broadcasts hold the show is suspended or expires. As the new service is inaugurated, two-hour terminal forecasts will be discontinued by ATCS stations.

Randall's Airport, Middletown, N. Y., has been purchased by Mr. and Mrs. Steve Benson and William B. Terry, Jr., for approximately \$75,000. They plan to develop business and provide plane operations there in addition to airplane activity.

DCS landing gear doors, developed by Research Writers, add 10 mph to the company demonstrator. Now in production, new doors fit flush with the engine nacelles. R.W. reports that the new doors decrease fuel consumption by 5.5 gph.

Reich Business No. 5000 has been delivered to Tulsa, Ok., Midwest, Okla. Business entered large-scale production in 1947.

General Electric Co., Schenectady, N. Y., awarded a Contract 316 for six by its Flight Test Division. —Cramer

31th purchased by USAP will have Airco Radio Corp. ADP-31 direction finder, replacing standard Radio navigational aid.

Problem of taking notes at high altitudes was solved recently by Philomena Mulla using the company's Toss Beech as a flying laboratory. Test was for beta 40 ft Navy personnel stationed at high altitude with Operation Deep Freeze who complained that notes weren't being. Investigation showed camp was 5,300 ft above sea level. Philomena took baked a note recorder, at that altitude, and using the procedure (old five table-spreads of lines and one and two-thirds cups of coffee to recipe, below in 400 deg.)

Directional antenna, weighing 1,100 lb., was hoisted into place atop Swedish TV station using a Sikorsky S-55.

Addition of pick control to Mitchell Industries Arches aerials sent a three-ton autopilot for light aircraft. Owners of several two-man Arches may return their airplanes and artificial horizon to the factory, Municipal Airport, Miami.



## Inflatoplane Is Modified

Latest model of Chrysler's inflatable car has engine in streamlined with reduced cockpit and motor gas (AW Feb. 11, 1946, p. 16). Rapid life struts have been replaced by strong wire for ease of packing and rubber pump has been replaced by turbo. Sixty a mode of inflatable tubes with connected by nylon threads. Cabot Inflatoplane, it was designed to test selected rubberized envelopes in structural members.

## Cold Junction Compensation For Airborne or Ground Use

With T-E's **AUTOREF** Units



**Airborne "AutoRef"** By providing constant-temperature reference of the thermocouple cold junction, the structure unit now permits accurate temperature readings for all types of flight applications—including rockets and guided missiles. Its design meets these essential airborne requirements: Light weight—only 22 oz.; small size— $1\frac{1}{2}'' \times 3'' \times 2\frac{1}{2}''$ ; ability to withstand severe conditions of vibration, acceleration and shock. A compensating bridge type unit, the "AutoRef" permits the pre-selection of almost any desired reference temperature and can adjust almost any existing voltage signals. It is inherently compensated for any standard thermocouple.



**Test Stand "AutoRef"** The standard "AutoRef" is ideal for test cell work or data reduction systems where temperature and other D.C. signals must be recorded together. Cold and compensation for the thermocouple output is provided by constant, pre-determined temperature in one, multi-thermocouple reference junction. Desired reference temperature can be controlled to within  $\pm 0.1^\circ\text{F}$ . over a wide range of ambient temperatures. Designed for panel rack mounting, the "AutoRef" has an integrated compensator in the thermocouple circuit, suitable for all standard calibrations. Capabilities up to several hundred points.

Write for Bulletin 81-C.

**Thermo Electric Co., Inc.**  
SADDLE BROOK, NEW JERSEY  
a division of THERMO ELECTRIC (Canada) Ltd., Toronto, Ontario

With, Tex., to have pitch sensor added for 5708. Complete three-control unit comprising roll and direction sensors, pitch sensor and amplifier, with cables, costs \$3,150 including modification of owner's gyro instruments. Complete unit weighs 11 lbs.

Moving Co., Newton, Ia., maker of weighing facilities and other heavy equipment, added a Paper Agency business plane to custom Aero Commander line, replacing overhauls in priority on hand. Moving's Aero Commander has now reached \$6,750 a unit, covering 150, 775 passenger seats. The plane several times has picked up critically needed material to keep production lines going.

Wingspan extensions and tip plates comprise new Republic RC-5 Sentinel modifications that reportedly increase rate of climb over 20%, shorten landing and takeoff distances 25% and 15% respectively and decrease stall speed at maximum gross weight by about ten miles per hour. Normal wingspan is increased and replaced with sections about 25 in. long in span, increasing span by 16 in. by plate sensors about 20 in. vertically by 60 in. long. No kits are being made available, since the needed parts are classified RC-5 secret items, but detailed plans are to be obtained from Ned C. Rice, 979 Silver Lane, E. Hartford 5, Conn. Modification is covered by CAA Supplemental Type Certificate SA-14.

Personnel of Page Airways, Rochester, N. Y., completed a 16-day specialized course on the Harvard Super Veejet business transport at Sea Airway, Tex., to prepare the fixed base operators for servicing the two-engine business transport. National Airlines Products, Inc., New York, recently took delivery of a Super Veejet fitted with Bendix audio and communication and navigation equipment, Sperry autopilot and Aero-primed fuel.

Bentch will assemble a quantity of L-13A and L-21E two-engine business planes to new L-21D configurations, including supercharged Lycoming powerplants. Reconfigured aircraft will have auto brake systems and engines. Completed, totaling some \$1.7 million, does not reflect Bentch's current production order for new L-21Ds.

Turtur 733 parametric autopilot production is now 50 units monthly and currently 18 distributors have been named to handle the equipment. Makin is Turtur, Inc., a division of Aircraft Products Co., Bridgeport, Pa.

FSC Applied Research, Ltd., designer and builder of computer and aerial survey equipment, has been acquired

Professional Pilots of Corporate Owned Aircraft, Business/Private Pilot and Owners, including Flying Schools, Farmers, Ranchers and Doctors, etc. Pilots and Owners, General Pilot and Students, Fixed Base Operators.

## SELL PILOTS . . .

WITH AN ADVERTISEMENT IN THE  
25TH ANNUAL AVIATION WEEK

## AIRPORT AND BUSINESS FLYING DIRECTORY

Publishing Date: June 1957

### LATEST RESEARCH SHOWS WHY THE AIRPORT DIRECTORY WORKS FOR YOU

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Address   
City   
Company



TACAN unit shown with covers removed; plane is a composite model.

## 78-page road map for jets

An 800-foot corridor may be as hard to find as a needle in a haystack, when the plane seeking it is at 30,000 feet and the time is 0000 hours.

To make the homing plane's homing process, we build the "ARN-21" TACAN equipment illustrated above. Its 78 tubes and associated components add up to a self-contained transmitter and

receiver, rugged in its ride-resistance and accurate in its point-to-point tolerances.

The manufacture of equipment as important and complicated as this demands perfection, and nothing less. On the military as well as the home front, Stromberg-Carlson has long displayed the ability to take such problems in stride.



**SC STROMBERG-CARLSON COMPANY**  
A DIVISION OF GENERAL DYNAMICS CORPORATION  
General Office and Facilities at Rochester, N. Y. • West Coast plants at San Diego and Los Angeles, Calif.



### Percival Form Planes

Group of production Percival P.P. 9 aircraft recently at the company's base, England, plant. Sixteen of the planes had been completed as of late last month. The company is building out every one made since the time the new material is drawn from stores. Designed to carry a pair of bombs or five passengers and baggage, the P.P. 9 is also built able to fly on four or six. Present lot ordered in uncommitted general Civilian of Air Force for the plane. One is going to Australia seen on a sales demonstration tour. Another will be shown at the Fair Air Show May 24-June 1.

by A. V. Roe Canada, Ltd., from Mustang Aviation Group.

Majesty interest in Rotax, Ltd., Michigan, Toronto, has been acquired by Corson, Ltd., aviation and aerospace engineering firm. Rotax is a helicopter repair, overhaul, maintenance and on-going facility.

Aerial survey of 10,000 sq. mi. in Tanguarville and Bouchardville, East Africa, will be handled by Force Air Services, Ltd. for the Directorate of Colonial Services. Survey will be used in geological research and interpretation of cattle grazing areas. Force will start operations in mid-April using a DC-3 with supercharged engines, completing the job by the end of July.

Advances of Aircraft to Canada is booklet detailing requirements, regulations, weather, navigation services, ports of entry for private aircraft wishing to travel across the border. Write: Canadian Government Travel Bureau, Dept. of Northern Affairs and Natural Resources, Ottawa, Canada.

Feetage of Fort Maclellan, N.B. 125-ton piece of heavy gun has been removed from its site.

Mold Aviation, Inc., Des Moines, Ia., is now Canadian distributor for 77 of the state's 90 counties. Frederick Richard and Robert Lloyd purchased American Aviation from George Harman to form the new sales and service firm, which is being expanded to employ 24. The Lloyd's background includes lumber and construction businesses.

Weymouth stockholders voted approval for the company to raise 1 million additional shares of common stock, doubling previous capitalization, to better expansion plans and provide funds to permit model changes in the company's line.

Genac SRE medium and low-level cruise plane become CFB plane in fleet of major aircraft and helicopter agencies in Spartan-Canadian Air Service, Ottawa, Canada.



### Supercharged Beech Joins the Army

Fast delivery of the new Beech L-119D advanced transport, military version of the E30 Twin Bonanza, has been made to the U. S. Army under a \$12.5 million purchase contract. Fifteen of the new Beech is in production 1969. Each is providing a top speed of 240 mph. Army is already operating similar models of the Twin Bonanza.

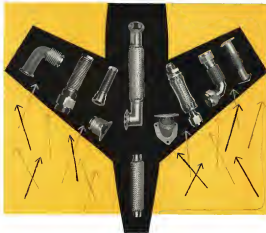
Aircraft Design & Pilot's Area, in training of 45 flight instructors in 100-day basic technique developed at University of Illinois to enable a non-piloted pilot to estimate themselves safely from unexpected instrument flight conditions. University studies have revealed that the average non-piloted pilot can expect to live approximately three minutes after flying into an obstacle. The 45 instructors who will undergo training—two from each state—will be obligated to give the training to other candidates in their area.

Planes are being made to handle 300-1,000 visiting aircraft and 1,100-1,500 guests at Reading Airman Service's 9th Annual Maintenance & Operations meeting for business and private pilots at Reading (Pa.) Municipal Airport June 1. Total of 50,000 to cash persons will be awarded to 14 houses and private planes in three categories and four weight classes.

Somebody Model Oil Company of New York has taken delivery of a Howard Super Vortex business transport fitted with RCA radio, Sperry autopilot and Collins communications and navigational systems.

Fluoro-Aircraft, Ltd., England, ordered a fourth Westland Whirlwind (Glasgow S.55) for industrial charter operation. FA now has two Westlands working in Nigeria for Shell B.P. Petroleum Exploration Co., experts to help two additional Westlands in that area to supplement its current fleet there.





## SYLPHON® BELLOWS FLEXIBLE CONNECTORS simplify design and operation of STRESS-LOADED AIRCRAFT COMPONENTS

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**Latest Model RB-66 Tested**

Employment and activity tests were begun for the latest model of the Douglas RB-66, the RB-66C, at the Air Force Ground Control Unit, Eglin AFB, Fla. The C model has additions on each wing and tail to speeded missile reconnaissance equipment. It makes four observations in addition to the three now done in earlier models. Photographs are taken (7 A) in excess of 7,000 ft. short







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## Navy Contracts

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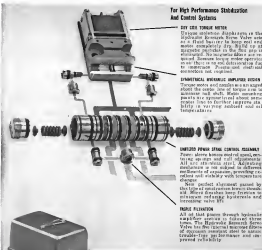


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Torque motor and amplifier are arranged about the center line of torque arm to minimize end shift. Motor, amplifier and valve are symmetrical about center line to further improve stability in varying ambient and oil temperature.

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Power stroke control is a single unit, with torque and end adjustments. All are symmetrical. Adjusting mechanism is not subject to differential movement of expansion, providing excellent end stability with temperature changes. Non perfect alignment caused by the type of seal reaction from the outside. All three double zero friction to minimum leakage hysteresis and increasing valve life.

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## SAFETY

### CAR Accident Investigation Reports

## C-82 Crashed on Emergency Go-Round

A Fairchild C-82A (Fisher), N 4837V, owned by South Lansing, Company and operated by Sgt. Spivey, a subsidiary of United States Army, Inc., and crashed in the "MIDWEST" proper crash during a go-round that an attempted landing at Fort Belvoir Airport, Fort Belvoir, Illinois, August 5, 1958, at approximately 2000 ft.

The pilot reported, that from emergency landing, was finally landed. The aircraft was damaged by ground air, and the landing gear.

### HISTORY

N 4837V assigned to the 1st Airborne Division, Fort Belvoir, Illinois, August 5, 1958. The aircraft was first flown by W. D. Cox, Captain for F. H. Cox, and then Captain, Captain, and then Captain.

The purpose of the dry 18 mile flight was to determine the aircraft's performance, and was performed by the 1st Airborne Division. The purpose of the flight was to determine the aircraft's performance, and was performed by the 1st Airborne Division.

Both aircraft were on the way to Fort Belvoir, Illinois, when the aircraft crashed. The aircraft was damaged by ground air, and the landing gear.

After going over the top, the aircraft of the 1st Airborne Division, a go-round was initiated. The aircraft crashed during the go-round, and the landing gear.

The 1st Airborne Division, 3225th Airborne, was on the way to Fort Belvoir, Illinois, when the aircraft crashed. The aircraft was damaged by ground air, and the landing gear.

### INVESTIGATION

The purpose of the wreckage was found to be 1,500 feet to the left of runway 4, and was found to be 1,500 feet to the left of runway 4, and was found to be 1,500 feet to the left of runway 4.

The purpose of the wreckage was found to be 1,500 feet to the left of runway 4, and was found to be 1,500 feet to the left of runway 4, and was found to be 1,500 feet to the left of runway 4.

night was low altitude on a landing of approximately 150 degrees. It was found to be 1,500 feet to the left of runway 4, and was found to be 1,500 feet to the left of runway 4.

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According to the CAA report, N 4837V crashed. The crash, consisting of two large, multiple loads, found near the center of gravity, and the two main parts, were determined to have been ejected. The aircraft was found to be 1,500 feet to the left of runway 4, and was found to be 1,500 feet to the left of runway 4.

The main wreckage was found to be 1,500 feet to the left of runway 4, and was found to be 1,500 feet to the left of runway 4, and was found to be 1,500 feet to the left of runway 4.

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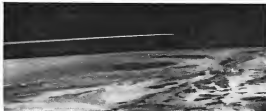
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## Career News for Engineers!

### Flight Tests are under way on one of America's most important defense projects:

## The Navaho Strategic Missile



The missile are correct—but this much can be said. A test vehicle designed the X-15 has gathered new aerodynamic and electronic information which will help in speed progress on the SSM-61 Intercontinental Strategic Guided Missile.

The opportunity—to test the privilege—to implement this revolutionary data is yours.



Twenty-eight-year-old Army Capt. WILLIAM J. SHIMMER was graduated from Georgia Tech in 1952 with a B.S. in Civil Aeronautics as a senior in process the same year. Seven months later he was promoted to assignment engineer for the Navaho missile program. His duties and duties were in October of last year with the first of North American's (Shimmo) SSM-61 test. He received his B.S. from USF and his wife are both engineers and they are proud parents of two children, California boys.

If you accept the challenge you'll be solving tomorrow's problems—today. Here facts are collected fresh daily. All year-round paid position—exclusive you'll approach the problem from a new dimension. You'll travel new paths and develop new concepts. And you'll be guided to such breakthrough by the world's best advanced missile engineers—your own associates.

One example of the new hardware evolving from the creative engineering effort is a fully transistorized electronic computer. This instrument increases the information-processing capabilities of the missile's telemetry system by compressing 27 outputs at speeds of approximately 300 cycles per second. It is de-

veloped by the Flight Test Instrumentation Group.

North American's Missile Development Division is a major leader of missile activity—and a pioneer in the field. As far back as 1946 its first test instrument vehicle was fired from a launching platform. Today North American has complete weapons system responsibility for the Navaho—and its test program is being conducted at the Air Force's long-range missile proving ground which stretches more than 5000 miles across the Caribbean and far into the South Atlantic.



LESLIE C. BROWN has just been out of his life. As a high school boy he built a plane model after the Wright brothers' first flying machine. Then it was all jumps over his head when he studied engineering at Utah State and earned his 1942 degree from the U.S. of Wyoming. Later he went North American in 1945 and is now Group Leader, Field Test Operations at the Wright Test Facility. He has been with the Air Force since 1945 and is now Group Leader, Field Test Operations at the Wright Test Facility. He has been with the Air Force since 1945 and is now Group Leader, Field Test Operations at the Wright Test Facility.

Let us know what kind of area test engineering offered you. Offer include highlights of your education and experience.

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## NORTH AMERICAN AVIATION, INC.



### SAFETY

of large, multi-engine aircraft had commenced in the spring of 1956. The C-124 aircraft was certified by the Civil Aeronautics Administration under the provisions of CAA Part 4 as a special project aircraft and not certified as such. The crew of N 481V had engaged in training operations with C-124 aircraft over 180 hours. Flying operations were considered as this instance, the N481V project, only at the last two or three hours of flight and actually only the flight crew was cleared the second. Captain G. L. had made no previous down landings at Boca Raton Airport.

The aircraft by itself, normally cleared down the runway, was not cleared and as planned to have been destroyed by ground fire.

A periodic inspection (N481V) of N 481V was conducted on June 1, 1956. The last 100 hour inspection was July 17, 1956. It first time the old plane of both engines was changed, the old engine was dismantled, and no more parts were found in the vicinity of either engine. Flying time since the last 100 hour inspection was 53 hours. The last flight inspection was made, the only one of August 1, 1956, as required by a company schedule.

He stated that he arrived at Miami Field before 0400 and observed Day and Hovey, checking their records. He did not question them, but observed that there was no engine the plane with its lights on and they were turning on a preflight inspection, such as a flight. This continued for about 20 minutes before they cleared the engines and tested over to the landing area where they shut down the engines. This vehicle stated that they while he was alone the other aircraft, both usually held off the runway for approximately 10 minutes. During which time he observed the engine of N 481V being run up. There was one hazard with a safety belt, installed off the cockpit area. There was no more with other belts for the other two passengers.

### ANALYSIS

It appears that before the left engine was started and running was preflight and occurred during the last few minutes of flight. At present, did not become apparent until the aircraft was at the north side of the runway. The cause of the landing loss could not be determined owing to the physical damage that had occurred.

However, the presence of damage to the left engine of parts suggest that inadequate lubrication caused by the condition may have started the failure. When N 481V was involved in the report, the loss of the engine was a good problem to find aircraft stuck on the runway.

The word was called and the engine by continuing with the landing lost could have caused the loss of the aircraft. The word was called and the engine by continuing with the landing lost could have caused the loss of the aircraft. The word was called and the engine by continuing with the landing lost could have caused the loss of the aircraft.

The engine manufacturer recommends a reduction of 750 rpm for the engine's reduction of standard power. It is doubtful

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### SAFETY

half of the portion was driven rearward during rapid operations which caused the spot power change. If so the energy not leaving may have been excessively loaded in these than containing in before.

It is believed that the case of N-451V did not become aware of a serious major malfunctioning until the personnel was alerted. The first approach had resulted in poor runway alignment, accelerating a go-around. The left propeller was not balanced during the subsequent go-around resulting in additional time.

Correct with the ground crew from a still "over-the-top" while in a left turn, as observed by the captain of the accompanying C-42. A breakdown of the results to lunch, because of a malfunctioning left engine and less runway, would be essential to the pilot's use of top tables and this action if one year that an "over-the-top" was still open.

Advancing the landing gear was observed to have been in the extended position while the aircraft was approaching the airport, maintenance of the landing gear was observed to the time of impact. C-42 landing gear release time indicates the average reaction time to be 1.2 seconds. The amount of time needed allows the gear to be situated during the left turn which caused approximately 1,400 feet.

### FINDINGS

On the basis of all available evidence the Board finds that:

1. The aircraft and crew were correctly certified.
2. Weather was not a factor.
3. Gross weight of the aircraft and distribution of the load were within permitted limits.
4. During approach to the airport runway malfunctioning of the left engine occurred.
5. An inadequately planned take-off approach resulted in runway undershoot and crew initiated a go-around.
6. During the subsequent go-around the left engine was started but having failed resulting in loss of power on the left engine.
7. The propeller was not locked for single-engine operation.
8. The lack of left engine power in loss, approach and the drag resulting from the unbalanced left propeller resulted in loss of directional control.
9. During the climbing left turn the aircraft was added and entered an "over-the-top" open.

### Possible Cause

The Board determines that the probable cause of this accident was loss of power on the left engine and the drag-induced effect of the unbalanced left propeller resulting in loss of directional control during an attempted go-around.

By the Civil Aeronautics Board:  
 Roy S. Davis  
 Chairman  
 James O. Doney  
 George W. Smith

### SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of the accident on October 8, 1966. An investigation was immediately started in

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### SAFETY

conformance with the provisions of Section 702 (a) (7) of the Civil Aeronautics Act of 1958, as amended. Operations were taken at Boca Raton, Florida, on September 5, 1956, at Miami, Florida, on September 6 and 7, 1956, and at Washington, D.C., on September 21, 1956.

#### Aircraft Operator

See item, for operating statistics of United Helicopters, Inc., a recently formed California corporation incorporating its principal office with the parent corporation in Richmond, California. United Helicopters, Inc., has acquired several, made-up and delivery aircraft since 1948.

Pilot Charles W. Day, age 34, was employed by United Helicopters, Inc., as co-pilot, Dec. 1955. He held a category effective across certificate with an engine instrument rating and a C-17, DC-3, and C-46 rating under commercial provision. He had a total of 5,575 flying hours of which 156 were in C-17 aircraft. He has been piloted commercial since September 20, 1955, and was general class test, no winners. The last instrument check was February 15, 1956, with check pilot (C-17) and check pilot of company, same check date.

Captain Ray F. Henry, age 33, was employed by United Helicopters, Inc., from 1950. He held a category effective across certificate with commercial pilot, engine instrument rating, and instrument rating. He had a total of 5,575 flying hours, of which 239 were in C-17 aircraft. He held class B physical certificate was passed on March 1, 1956, with no winners.

#### The Aircraft

Perfected model C-17A, N 4812W, serial number 41-21334A, was manufactured in 1944. Total flying hours were 1,316. The aircraft was equipped with two Pratt and Whitney model R1560-37 engines. The total time and time since overhaul was 235 hours, and 179 hours for the left and right engines, respectively. The propellers were Hamilton Standard model 60A80-81 with total time of 2,136 hours and 2,151 hours on the left and right propellers, respectively. These were overhauled on 185 hours and 191 hours.

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